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U58d

INVITATION NO. CIVENG-23-065-57-25

STATE WATER SURVEY DIVISION
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F. 627.8 U582d and. F. 627-8 U582da
drawings

DEVIL'S KITCHEN DAM

WILLIAMSON COUNTY, ILLINOIS

ILLINOIS STATE WATER SURVEY LIBRARY COPY
FEB 5 00

SPECIFICATIONS
FOR
COMPLETION OF DAM

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
ST. LOUIS DISTRICT
ST. LOUIS, MISSOURI

SEPTEMBER 1956

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00060107
DEVIL'S KITCHEN DAM :
WILLIAMSON COUNTY,
ILLINOIS : SPECIFICATIONS
FOR COMPLETION OF DAM.

DATE
ISSUED TO

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00060107
DEVIL'S KITCHEN DAM :
WILLIAMSON COUNTY,
ILLINOIS : SPECIFICATIONS
FOR COMPLETION OF DAM.

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STANDARD FORM 20
REVISED MARCH 1953
GENERAL SERVICES ADMINISTRATION
GENERAL REGULATION NO. 13

INVITATION FOR BIDS
(CONSTRUCTION CONTRACT)

REFERENCE
Invitation No.
CIVENG-23-065-57-25

DATE
21 September 1956

NAME AND LOCATION OF PROJECT COMPLETION OF DEVIL'S KITCHEN DAM, WILLIAMSON COUNTY, ILLINOIS

DEPARTMENT OR AGENCY
DEPARTMENT OF THE ARMY

BY (issuing office)
DISTRICT ENGINEER, ST. LOUIS DISTRICT
CORPS OF ENGINEERS, US ARMY
420 LOCUST STREET
ST. LOUIS 2, MISSOURI

Sealed bids in duplicate for furnishing all labor, equipment, and materials* and performing all work for the project described herein will be received until 2:00 P. M., Central Daylight Savings Time, (1:00 P.M., Central Standard Time), 19 October 1956, in Room 961 of the above issuing office,

*except property to be furnished by the Government as provided in paragraph SC-09 of the specifications.

and then publicly opened.

Information regarding bidding material, bid guarantee, and bonds

1. Bid bond on U. S. Standard Form No. 24 in a penal sum of not less than 20% of the bid price will be required with each bid if the bid price is in excess of $2,000.

2. The successful bidder will be required to execute Payment and Performance Bonds, as prescribed in paragraph GC-17 of the specifications, if the contract exceeds $2,000.

3. An inspection trip to enable prospective bidders to visit the site of the work including warehouse in Crab Orchard Wildlife Refuge will be made on 4 October 1956. Bidders desiring to make the trip shall notify the above office at least two days in advance of that date. Upon receipt of such notification, a Government representative having knowledge of the proposed work will meet any bidders desiring to make the inspection trip in front of the Post Office at Carbondale, Illinois at 1:00 P.M., Central Standard Time (2:00 P.M., Central Daylight Savings Time), on the above date.

Description of work

4. The work consists of furnishing all plant, labor, equipment and materials (except property to be furnished by the Government as provided in paragraph SC-09 of the specifications) and performing all work in strict accordance with these specifications and schedules and drawings forming parts thereof for completion of Devil's Kitchen Dam at the Crab Orchard Federal Wildlife Refuge Area in Williamson County, Illinois.

Information regarding liquidated damages (if any), payments, etc., is attached or made a part of the specifications. Bids shall be submitted on the forms furnished or copies thereof.

NOTE: Read the following in conjunction with the inclosed "Instructions to Bidders," (U. S. Standard Form 22).

5. Plant.- The bidder shall state in his bid that he has available or under his control, plant of the character and in the amount required to complete the proposed work within the specified time. Each bidder shall furnish a list of the plant proposed for use on the work.

6. Modification Prior to Date Set for Opening Bids.- The right is reserved, as the interest of the Government may require, to revise or amend the specifications and/or drawings, prior to the date set for opening bids. Such revisions and amendments, if any, will be announced by an addendum or addenda to the Invitation for Bids. Copies of such addenda as may be issued will be furnished to all prospective bidders. If the revisions and amendments are of a nature which require material changes in quantities or prices bid or both, the date set for opening bids may be postponed by such number of days as in the opinion of the District Engineer, will enable bidders to revise their bids. In such case, the addendum will include an announcement of the new date for opening bids.

7. Award of Contract.- Paragraph 11(c) of the "Instructions to Bidders" (U. S. Standard Form 22) shall be deleted. Award will be made as a whole to one bidder.

8. The successful bidder will be required to execute U. S. Standard Form 23 - Construction Contract, U. S. Standard Form 23A - General Provisions (Construction Contracts), and amendments thereto. Copies of these forms are inclosed herewith.

STANDARD FORM 21 *Stencil, front side.* REVISED MARCH, 1953 GENERAL SERVICES ADMINISTRATION GENERAL REGULATION NO. 13	BID FORM (CONSTRUCTION CONTRACT)	REFERENCE Invitation No. CIVENG-23-065-57-25
Read the Instructions to Bidders (Standard Form 22) *This form to be submitted in* duplicate		DATE OF INVITATION 21 September 1956

NAME AND LOCATION OF PROJECT COMPLETION OF DEVIL'S KITCHEN DAM, WILLIAMSON COUNTY, ILLINOIS

(Date)

TO: District Engineer
St. Louis District
Corps of Engineers, US Army
420 Locust Street
St. Louis 2, Missouri

In compliance with your invitation for bids of the above date, the undersigned hereby proposes to furnish all labor, equipment, and materials (except property to be furnished by the Government as provided in paragraph SC-09 of these specifications) and perform all work for completion of Devil's Kitchen Dam,

at the Crab Orchard Federal Wildlife Refuge Area in Williamson County, Illinois,

in strict accordance with the specifications, schedules, drawings, and conditions for the consideration of the following amount(s) listed on Pages III and IV, "Unit Price Schedule,"

and agrees that, upon written acceptance of this bid, mailed, or otherwise furnished, within calendar days (30 calendar days unless a shorter period be inserted by the bidder) after the date of opening of bids, he will within 10 calendar days (unless a longer period is allowed) after receipt of the prescribed forms, execute Standard Form 23, Construction Contract,* and give performance bond and payment bond on Government standard forms, if these forms are required, with good and sufficient surety or sureties.

* Standard Form 23A General Provisions and Amendments thereto.

(Continue on other side)

The undersigned agrees that if awarded the contract, he will commence the work within 10 calendar days after the date of receipt of notice to proceed, and that he will complete the work within 840 calendar days after the date of receipt of notice to proceed.

The undersigned acknowledges receipt of the following addenda to the drawings and/or specifications *(Give number and date of each):*

NOTE: Failure to acknowledge receipt of each addendum may be cause for rejection of the bid.

The undersigned represents *(Check appropriate boxes):* (1) that the aggregate number of employees of the bidder and its affilates is ☐ 500 or more, ☐ less than 500; (2) (a) that he ☐ has ☐ has not, employed or retained any company or person *(other than a full-time bona fide employee working solely for the bidder)* to solicit or secure this contract; and (b) that he ☐ has, ☐ has not, paid or agreed to pay to any company or person *(other than a full-time bona fide employee working solely for the bidder)* any fee, commission, percentage or brokerage fee, contingent upon or resulting from the award of this contract, and agrees to furnish information relating thereto as requested by the contracting officer. *(Note: For interpretation of the representation, including the term "bona fide employee," see General Services Administration Regulations, Title 44, secs. 150.7 and 150.5(d) Fed. Reg., Dec. 31, 1952, Vol. 17, No. 253.)*

Enclosed is bid guarantee, consisting of

in the amount of

NAME OF FIRM OR INDIVIDUAL *(Type or print)*	FULL NAME OF ALL PARTNERS *(Type or print)*
BUSINESS ADDRESS *(Type or print)*	
BY *(Signature in ink. Type or print name under signature)*	
TITLE *(Type or print)*	
STATE OF INCORPORATION *(Type or print)*	

DIRECTIONS FOR SUBMITTING BIDS

Envelopes containing bids, guarantee, etc., must be sealed, marked, and addressed as follows:

Mark in upper left hand corner "Bid for Invitation No. CIVENG-23-065-57-25 Completion of Devil's Kitchen Dam, to be opened at 2:00 P.M., Central Daylight Saving Time, (1:00 P.M., Central Standard Time), 19 October 1956."

Address Bids to: District Engineer
St. Louis District
Corps of Engineers, U. S. Army
420 Locust Street, St. Louis 2, Missouri

CAUTION: Do not include in the envelope any bids for other work.
Bids should not be qualified by exceptions to the bidding conditions.

UNIT PRICE SCHEDULE

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
1.	Excavation, Earth, Main Dam	1,100	cu.yd.	$______	$______
2.	Excavation, Structure, Auxiliary Spillway	4,000	cu.yd.	______	______
3.	Excavation, Access Roads and Auxiliary Spillway	22,400	cu.yd.	______	______
4.	Excavation, Rock	1,260	cu.yd.	______	______
5.	Care of Water	sum	job		______
6.	Fill and Backfill, Tamped, 6" Layers	1,100	cu.yd.	______	______
7.	Embankment, Compacted, 8" Layers	7,500	cu.yd.	______	______
8.	Embankment, Semicompacted, 12" Layers	550	cu.yd.	______	______
9.	Removal, Old Concrete	150	cu.yd.	______	______
10.	Concrete, Mass	28,400	cu.yd.	______	______
11.	Concrete, Facing	1,440	cu.yd.	______	______
12.	Concrete, Parapet Walls, Valve House, Stilling Basin and Training Walls	1,880	cu.yd.	______	______
13.	Concrete, Auxiliary Spillway	1,204	cu.yd.	______	______
14.	Cement, Portland	42,400	bbl.	______	______
15.	Steel, Reinforcement	280,460	lb.	______	______
16.	Waterstops, Vinyl	1,655	lin.ft.	______	______
17.	Foundation Drilling and Grouting:				
	a. Mobilization and Demobilization	sum	job		______
	b. Pipe, 2½" Diameter for Grouting	120	lin.ft.	______	______
	c. Drilling Grout Holes	2,450	lin.ft.	______	______
	d. Drilling Drain Holes	1,320	lin.ft.	______	______
	e. Grout, Portland Cement	2,000	cu.ft.	______	______
	f. Connections to Grout Holes	50	each	______	______
	g. Contact Grouting System	sum	job	______	______

NOTES: (a) All extensions of the unit prices shown will be subject to verification by the Government. In case of variation between the unit price and the extension, the unit price will be considered to be the bid.

(b) If a bid or modification to a bid based on unit prices is submitted and provides for a lump sum adjustment to the total estimated cost, the application of the lump sum adjustment to each unit price, including lump sum units, in the bid schedule must be stated or, if it is not stated, the bidder agrees that the lump sum adjustment shall be applied on a pro-rata basis to every unit price in the bid schedule.

PLANT AND EQUIPMENT SCHEDULE

AVAILABLE PLANT TO BE USED

No.	Type	Capacity	Manufacturer	Age & Condition	Location
			*		
			*		
			*		

NOTE: To be filled in by bidder. *Provide headings and list separately each type of equipment such as Excavating, Compacting, Concrete Plant, Material Handling, etc. Use separate line for each major item. Use additional page if necessary.

Engineer Form No. 1619-R
15 September 1955

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Invitation No. CIVENG-23-065-57-25
21 September 1956

CORPS OF ENGINEERS, U. S. ARMY
ST. LOUIS DISTRICT
420 Locust Street, St. Louis 2, Mo.

SPECIFICATIONS FOR COMPLETION OF DEVIL'S KITCHEN DAM WILLIAMSON COUNTY, ILLINOIS

PART I -- STATEMENT OF WORK

SW-01. DESCRIPTION OF WORK.- (a) Work to be Done.- The work consists of furnishing all plant, labor, equipment and materials (except property to be furnished by the Government as provided in paragraph SC-09 of these specifications) and performing all work in strict accordance with these specifications and schedules and drawings forming parts thereof for Completion of Devil's Kitchen Dam at Crab Orchard Federal Wildlife Refuge Area in Williamson County, Illinois.

(b) Location.- The site of the work contemplated by these specifications is on Grassy Creek in the Crab Orchard Federal Wildlife Refuge Area, Williamson County, Illinois, approximately 11 miles southeast of Carbondale, Illinois.

(c) Appropriation.- 96-14X1932, Construction, Fish and Wildlife Service, (Allocated Working Fund to Corps of Engineers, Civil), Devil's Kitchen Dam on the Crab Orchard Wildlife Refuge, Illinois.

(d) Authority.- The work provided for herein is authorized by Public Law 78, 84th Congress, 16 June 1955.

SW-02. PRINCIPAL FEATURES.- The work to be performed includes the following principal features:

(1) Foundation drilling and grouting.
(2) Concrete work for dam and auxiliary spillway.
(3) Drainage and discharge piping.
(4) Valve house equipment including gate and butterfly valves and overhead crane.
(5) Electrical work.
(6) Ventilating system.
(7) Earth dam embankment.
(8) Grading for access roads and auxiliary spillway.
(9) Crushed stone road surfacing.
(10) Stone protection work.
(11) Government field office.

The above general outline of principal features does not in any way limit the responsibility of the Contractor to perform all work and furnish all plant, labor and materials required by the specifications and the plans and drawings referred to therein.

SW-03. REDUCTION OF WORK.- Due to seasonal limitations prescribed for mulching, fertilizing and seeding in paragraph 17-02, the Government reserves the right to eliminate Quantity Items Nos. 34 and 35 from the contract, in event all other work under the contract has been completed.

SPECIFICATIONS

PART II -- GENERAL CONDITIONS

GC-01. SCOPE OF WORK.- The work to be performed under this contract consists of furnishing all plant, materials, equipment, supplies, labor and transportation, including fuel, power, water (except any materials,equipment, utility or service, if any, specified herein to be furnished by the Government), and performing all work as required in the Statement of Work in the contract, in strict accordance with the specifications, schedules, and drawings, all of which are made a part hereof, and including such detail drawings as may be furnished by the Contracting Officer from time to time during the prosecution of the work in explanation of said drawings.

GC-02. CHARACTER OF WORK AND MECHANICS.- The work shall be executed in the best and most workmanlike manner by qualified, careful and efficient mechanics in strict accordance with the drawings and specifications.

GC-03. SITE INVESTIGATION.- The Contractor acknowledges that he has satisfied himself as to the nature and location of the work, the general and local conditions, including but not restricted to those bearing upon transportion, disposal, handling and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, river stages, tides or similar physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during prosecution of the work. The Contractor further acknowledges that he has satisfied himself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Government as well as from information presented by the drawings and specifications made a part of this contract. Any failure by the Contractor to acquaint himself with the available information will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the work. The Government assumes no responsibility for any conclusions or interpretations made by the Contractor on the basis of the information made available by the Government. The Government also assumes no responsibility for any understanding or representations made by its officers or agents during or prior to the execution of this contract, unless (i) such understanding or representations are expressly stated in the contract and (ii) the contract expressly provides that the responsibility therefor is assumed by the Government. Representations which are not expressly stated in the contract and for which liability is not expressly assumed by the Government in the contract shall be deemed only for the information of the Contractor.

GC-04. OPERATIONS AND STORAGE AREAS.- (a) All operations of the Contractor (including storage of materials) upon Government premises shall be confined to areas authorized or approved by the Contracting Officer. No unauthorized or unwarranted entry upon or passage through, or storage or disposal of materials shall be made upon Government premises. Government premises adjacent to the construction will be made available for use by the Contractor without cost whenever such use will not interfere with other Government uses or purposes.

The Contractor shall be liable for any and all damage caused by him to such Government premises. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature or kind arising from any use, trespass or damage occasioned by his operations on premises of third persons.

(b) Temporary buildings (storage sheds, shops, offices, etc.) may be erected by the Contractor only with the approval of the Contracting Officer, and shall be built with labor and materials furnished by Contractor without expense to the Government. Such temporary buildings and/or utilities shall remain the property of the Contractor and will be removed by him at his expense upon the completion of the work. With the written consent of the Contracting Officer, such buildings and/or utilities may be abandoned and need not be removed.

(c) The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways or construct and use such temporary roadways as may be authorized by the Contracting Officer. Where materials are transported in the prosecution of the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any federal, state or local law or regulation. When it is necessary to cross curbings or sidewalks, protection against damage shall be provided by the Contractor and any damaged roads, curbings, or sidewalks shall be repaired by, or at the expense of the Contractor.

GC-05. PROGRESS CHARTS AND REQUIREMENTS FOR OVERTIME WORK.- (a) The Contractor shall within 5 days or within such time as determined by the Contracting Officer, after date of commencement of work, prepare and submit to the Contracting Officer for approval a practicable schedule, showing the order in which the Contractor proposes to carry on the work, the date on which he will start the several salient features (including procurement of materials, plant and equipment) and the contemplated dates for completing the same. The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion at any time. The Contractor shall enter on the chart the actual progress at the end of each week or at such intervals as directed by the Contracting Officer, and shall immediately deliver to the Contracting Officer three copies thereof.

(b) If, in the opinion of the Contracting Officer, the Contractor falls behind the progress schedule, the Contractor shall take such steps as may be necessary to improve his progress and the Contracting Officer may require him to increase the number of shifts, and/or overtime operations, days of work, and/or the amount of construction plant, and to submit for approval such supplementary schedule or schedules in chart form as may be deemed necessary to demonstrate the manner in which the agreed rate of progress will be regained, all without additional cost to the Government.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under the provision shall be grounds for determination by the Contracting Officer that the Contractor is not prosecuting the work with such diligence as will insure completion within the time specified. Upon such determination the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part thereof, in accordance with the clause of the contract entitled "Termination for Default-Damages for Delay-Time Extensions."

GC-06. SUBCONTRACTORS.- At the request of the Contracting Officer the Contractor shall notify the Contracting Officer, in writing, of the names of all subcontractors, together with a summary of the extent and character of the work to be done by each subcontractor. If for sufficient reason, at any time during the progress of the work, the Contracting Officer determines that any subcontractor is incompetent or undesirable, he will notify the Contractor accordingly and immediate steps will be taken for cancellation of such subcontract. Subletting by subcontractors shall be subject to the same regulations. Nothing contained in this contract shall create any contractual relation between the subcontractor and the Government.

GC-07. QUALITY OF ARTICLES, MATERIALS AND EQUIPMENT.- (a) Articles, materials, and equipment to be incorporated into the work under the contract shall be new and unused unless otherwise specified; and, where required to conform to standard specifications of the Government or other authorities incorporated by reference, will conform to the respective editions, including amendments, specified, or, where the editions are not specified will conform to the editions including amendments in effect on the date of the Invitation for Bids.

(b) Any samples and descriptive data required shall:

(1) Be submitted within the time specified in these specifications or, if no time be specified, within a reasonable time before use to permit inspection and testing.

(2) Be shipped prepaid and delivered as specified in these specifications, or as directed by the Contracting Officer.

(3) Be properly marked to show the name of the material, trade name of manufacturer, place of origin, name and location of the project where the material represented by the sample is to be used, and the name of the Contractor submitting the sample.

(c) Samples not subjected to destructive tests may be retained until completion of the work but thereafter will be returned to the Contractor, if he so requests in writing, at his own expense. Failure of any sample to pass the specified requirements will be sufficient cause for refusal to consider further any samples from the same manufacturer whose materials failed to pass the tests.

GC-08. PROTECTION OF MATERIAL AND WORK.- The Contractor shall at all times protect and preserve all materials, supplies and equipment of every description (including property which may be Government-furnished or owned) and all work performed. All reasonable requests of the Contracting Officer to inclose or specially protect such property shall be complied with. If, as determined by the Contracting Officer, material, equipment, supplies and work performed are not adequately protected by the Contractor such property may be protected by the Government and the cost thereof may be charged to the Contractor or deducted from any payments due to him.

GC-09. PROTECTION OF EXISTING STRUCTURES, UTILITIES, WORK AND VEGETATION.- (a) Any damage to existing structures or work of any kind, or the interruption of a utility service resulting from failure to comply with the requirements of the clause of the contract entitled "Permits and Responsibility for Work, Etc." shall be repaired or restored promptly by or at the expense of the Contractor.

(b) The Contractor will preserve and protect all existing vegetation such as trees, shrubs, and grass on or adjacent to the site which do not unreasonably interfere with the construction as may be determined by the Contracting Officer. The Contractor will be responsible for all unauthorized cutting or damaging of trees and shrubs, including damage due to careless operation of equipment, stockpiling of materials or tracking of grass areas by equipment.

(c) Care will be taken by the Contractor in felling trees authorized for removal to avoid any unnecessary damage to vegetation that is to remain in place. Any limbs or branches of trees broken during such operations, shall be trimmed with a clean cut and painted with an approved tree pruning compound if required by the Contracting Officer. The Contractor will be liable for or may be required to replace or restore at his own expense all vegetation not protected and preserved as required herein that may be destroyed or damaged.

GC-10. POSSESSION PRIOR TO COMPLETION.- The Government shall have the right to take possession of or use any completed or partially completed part of the work. Such possession or use shall not be deemed an acceptance of any work not completed in accordance with the contract. If such prior possession or use by the Government delays the progress of the work or causes additional expenses to the Contractor, an equitable adjustment in the contract price and/or the time of completion will be made and the contract shall be modified in writing accordingly.

GC-11. SUSPENSION OF WORK.- The Contracting Officer may order the Contractor to suspend all or any part of the work for such period of time as may be determined by him to be necessary or desirable for the convenience of the Government. Unless such suspension unreasonably delays the progress of the work and causes additional expense to the Contractor, no increase in contract price will be allowed. In the case of suspension of all or any part of the work for an unreasonable length of time causing additional expense, not due to the fault or negligence of the Contractor, the Contracting Officer shall make an adjustment in the contract price in the amount of the additional proper expense and modify the contract accordingly. An extension of time for the completion of the work in the event of any such suspension will be allowed the Contractor; provided, however, that the suspension was not due to the fault or negligence of the Contractor.

GC-12. LABOR REPORTS.- The Contractor shall promptly furnish, and shall cause any subcontractors to furnish in like manner, within 7 days after the regular payment date of each weekly payroll, to the Contracting Officer, a copy of such payroll together with a sworn affidavit with respect to the wages paid each of its employees (which shall not be deemed to apply to persons in classifications higher than laborers and mechanics and those who are the immediate supervisors of such employees) engaged on the work. The Contractor shall also prepare and furnish such labor reports as may be required by the Department of Labor.

GC-13. NOTICE TO THE GOVERNMENT OF LABOR DISPUTES.- Whenever the Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay the timely performance of the contract work, the Contractor shall immediately give notice thereof, including all relevant information with respect thereto, to the Contracting Officer.

GC-14. CLEANING UP.- The Contractor shall at all times keep the construction area, including storage areas used by him, free from accumulations of waste material or rubbish and prior to completion of the work remove any rubbish from the premises and all tools, scaffolding, equipment, and materials not the property of the Government. Upon completion of the construction the Contractor shall leave the work and premises in a clean, neat and workmanlike condition satisfactory to the Contracting Officer.

GC-15. USE OF DOMESTIC ARTICLES.- Because the materials listed below, or the materials from which they are manufactured, are not mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality, their use in the work herein specified (subject to the requirements of the specifications) is authorized without regard to the country of origin:

Aluminum, pig and ingot
Antimony, as metal or oxide
Asbestos, amosite
Bismuth
Cadmium
Chrome ore or chromite
Cobalt, in cathodes, rondelles or other primary forms
Copper, refined, in ingots cathodes or other refinery shapes
Cork, wood or bark and waste
Graphite, crystalline, flake
Jute and jute burlaps
Lac and shellac
Logs, veneer, and lumber from Alaskan yellow cedar, balsa, greenheart, lignum vitae, mahogany and teak
Mercury
Mica
Nickel, primary, in ingots, pigs, shot, cathodes or similar forms; nickel oxide and nickel salts
Rubber, crude and latex
Tin, in bars, blocks and pigs

GC-16. DEFINITIONS.- (a) Wherever in the specifications or upon the drawings the words directed, required, permitted, ordered, designated, prescribed or words of like import are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the Contracting Officer is intended and similarly the words approved, acceptable, satisfactory, or words of like import shall mean approved by, or acceptable to, or satisfactory to the Contracting Officer, unless otherwise expressly stated.

(b) Basic rate as used in contract Clause 21, "Eight-Hour Law - Overtime

Compensation," means the basic hourly straight time wage rate actually paid laborers and mechanics and is not necessarily the same as the minimum hourly rate referred to in Clause 20, "Davis-Bacon Act," and in the paragraph of the specifications entitled "Rates of Wages."

GC-17. BONDS.- (a) Payment Bond.- If the contract exceeds $2,000 the Contractor agrees to furnish a payment bond with good and sufficient surety or sureties acceptable to the Government for the protection of persons furnishing material or labor in connection with the performance of the work under this agreement on U. S. Standard Form No. 25-A or U. S. Standard Form No. 25-C. The penal sum of such payment bond will be as follows: (1) When the contract price is $1,000,000 or less, 50 percent of the contract price; (2) When the contract price is in excess of $1,000,000 but no more than $5,000,000, 40 percent of the contract price; (3) When the contract price is more than $5,000,000, $2,500,000.

(b) Performance Bond.- If the contract price exceeds $2,000 the Contractor further agrees to furnish a performance bond with good and sufficient surety or sureties acceptable to the Government in connection with the performance of the work under this agreement on U. S. Standard Form No. 25 or U. S. Standard Form No. 25-B. The penal sum of such performance bond will be 50 percent of the contract price.

(c) Any bonds required hereunder will be dated as of the same date as the contract and will be furnished by the Contractor to the Government at the time the contract is executed.

GC-18. ACCIDENT PREVENTION.- In addition to full compliance with the requirements of the clause of the contract entitled "Accident Prevention," the Contractor will comply with the following provisions:

(a) Prior to commencement of work the Contractor will:

(1) Submit in writing, to the Contracting Officer, his proposals for effectuating the provisions of the clause of the contract entitled "Accident Prevention."

(2) Meet in conference with representative of the Contracting Officer to discuss and develop mutual understandings relative to administration of the over-all safety program.

(b) During the performance of work under the contract, the Contractor shall comply with all procedures prescribed by the Contracting Officer for the control and safety of persons visiting the job site and will comply with such requirements to prevent accidents as may be specified under the Special Conditions of these specifications or issued by the Contracting Officer.

GC-19. INSPECTION.- The work will be conducted under the general direction of the Contracting Officer and is subject to inspection by his appointed inspectors to insure strict compliance with the terms of the contract. No inspector is authorized to change any provision of the specifications without written authorization of the Contracting Officer, nor shall the presence or absence of an inspector relieve the Contractor from any requirements of the contract. As soon as practicable after the completion of the entire work, or any divisible part thereof as may be designated in these specifications, a thorough examination thereof will be made by the Contracting Officer at the site of the work. If such work is found to comply fully with the requirements of the contract, it will be accepted; and final payment therefor will be made in accordance with the clause of the contract entitled "Payments to Contractors."

GC-20. ITEMS OF WORK.- A brief description of each item and the estimated quantity thereof are shown in the schedule attached to the Bid Form and listed in the Statement of Work in the contract. Unless otherwise provided in the Special Conditions, within the limit of available funds, the Contractor will be required to complete the work specified herein in accordance with the contract and at the contract price or prices.

GC-21. AUTHORIZATION AND CONSENT.- The Government hereby gives its authorization and consent (without prejudice to its rights of indemnification, if such rights are provided for in this contract) for all use and manufacture, in the performance of this contract or any part hereof or any amendment hereto or any subcontract hereunder (including any lower-tier subcontract), of any patented invention (i) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this contract, or (ii) utilized in the machinery, tools or methods the use of which necessarily results from compliance by the Contractor or the using subcontractor with (a) specifications or written provisions now or hereafter forming a part of this contract, or (b) specific written instructions given by the Contracting Officer directing the manner of performance. The Contractor's entire liability to the Government for patent infringement shall be determined solely by the provisions of the indemnity clause, if any, included in the contract and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

GC-22. PATENT INDEMNITY (PREDETERMINED).- If the amount of this contract is in excess of $5,000, the Contractor shall indemnify the Government and its officers, agents, and employees against liability, including costs, for infringement of any United States letters patent (except letters patent issued upon an application which is now or may hereafter be kept secret or otherwise withheld from issue by order of the Government) arising out of the manufacture or delivery of supplies or out of construction, alteration, modification, or repair of real property (hereinafter referred to as "construction work") under this contract, or out of the use or disposal by or for the account of the Government of such supplies or construction work. The foregoing indemnity shall not apply unless the Contractor shall have been informed as soon as practicable by the Government of the suit or action alleging such infringement, and shall have been given such opportunity as is afforded by applicable laws, rules, or regulations to participate in the defense thereof; and further, such indemnity shall not apply if: (1) the infringement results from compliance with specific written instructions of the Contracting Officer directing a change in the supplies to be delivered or in the materials or equipment to be used, or directing a manner of performance of the contract not normally used by the Contractor; or (ii) the infringement results from the addition to, or change in, the supplies furnished or construction work performed, which addition, or change was made subsequent to delivery or performance by the Contractor; or

(iii) the claimed infringement is settled without the consent of the Contractor, unless required by final decree of a court of competent jurisdiction.

GC-23. NOTICE AND ASSISTANCE REGARDING PATENT INFRINGEMENT.- The provisions of this clause shall be applicable only if the amount of this contract is in excess of $5,000.

(a) The Contractor shall report to the Contracting Officer, promptly and in reasonable written detail, each notice or claim of patent infringement based on the performance of this contract of which the Contractor has knowledge.

(b) In the event of litigation against the Government on account of any claim of patent infringement arising out of the performance of this contract or out of the use of any supplies furnished or work or services performed hereunder, the Contractor shall furnish to the Government, upon request, all evidence and information in possession of the Contractor pertaining to such litigation. Such evidence and information shall be furnished at the expense of the Government except in those cases in which the Contractor has agreed to indemnify the Government against the claim being asserted.

GC-24. REPORTING OF ROYALTIES.- The provisions of this clause shall be applicable only if the amount of the contract is in excess of $10,000.

(a) The Contractor shall report in writing (in quadruplicate) to the Contracting Officer as soon as practicable after execution of this contract whether or not any royalties in excess of $250 have been paid or are to be paid by the Contractor directly to any person or firm in connection with the performance of this contract. If royalties in excess of $250 have been paid or are to be paid to any person or firm, the report shall include the following items of information with respect to such royalties (including the initial $250):

(1) The name and address of each licensor to whom royalties in excess of $250 have been paid or are to be paid,

(2) The patent numbers, patent application serial numbers (with filing dates), or other identification of the basis for such royalties,

(3) The manner of computing the royalties consisting of (i) a brief identification of each royalty-bearing unit or process, (ii) the total amount of royalties, and (iii) the percentage rate or dollars and cents amount of royalties on each such unit or process; provided that if the royalties cannot be computed in terms of units or dollars and cents value, then other data showing the manner in which the Contractor computes the royalties.

(b) In lieu of furnishing a report under paragraph (a), the Contractor may furnish a single, consolidated report for each accounting period of the Contractor during which the Contractor has contracts with the Government, provided the Contractor has requested and obtained the prior written approval of the Chief, Patents Division, Office of The Judge Advocate General. Such consolidated report shall be furnished, when the furnishing thereof has been approved, in the number of copies as approved, as soon as practicable after the close of the accounting period covered by the report. Such consolidated report shall be made in accordance with Contractor's established accounting practice and shall include, for the accounting period, the total amount of royalties accruing to each licensor at a rate in excess of $1,000 per annum on the Contractor' over-all business, together with (i) the name and address of each such licensor, (ii) the patent numbers, patent application serial numbers (with filing dates), or other identification of the basis for such royalties, (iii) a brief description of the subject matter of the license under which royalties are charged, (iv) the percentage rate or unit amount, or if the royalties do not accrue by rate or unit amount, such other data showing the manner by which the royalties accrue to licensor, and (v) an estimate or approximation (without detailed accounting) of the portion of such royalties that may be attributable to Government contracts. The Contractor shall, if requested by the Government, furnish at Government expense a more detailed allocation of such royalty payment attributable to Government contracts.

(c) In the event that the Contractor requests written approval to furnish consolidated reports under paragraph (b) above, the Chief, Patents Division, Office of The Judge Advocate General shall promptly consider the request and furnish to the Contractor a letter stating whether or not the request is approved and, notwithstanding any such approval, the Contracting Officer shall have the right to question any such subsequently furnished report as to accuracy or completeness of data and to ask for additional information. The Contractor shall furnish a copy of such letter of approval to the Contracting Officer administering this contract.

(d) After payment of eighty percent (80%) of the amount of this contract, as from time to time amended, further payment shall be withheld until a reserve of either (i) ten percent (10%) of such amount or (ii) $5,000, whichever is less, shall have been set aside, such reserve or the balance thereof to be retained until the Contractor shall have furnished to the Contracting Officer the report called for by paragraph (a) hereof or the copy of the letter approving the Contractor's request to furnish the report under paragraph (b); provided, that no amount shall continue to be withheld from payment for the causes specified in this paragraph (d) if the Contracting Officer shall find that the Contractor has not been furnished a letter as required by paragraph (c) within a reasonable time after making written request to submit a single, consolidated report under the provisions of paragraph (b) of this clause; and provided further, that the Contracting Officer may, in his discretion, order payment to be withheld in the amount and manner above provided if the report called for by paragraph (a) is unsatisfactory or if the Chief, Patents Division, Office of The Judge Advocate General notifies the Contracting Officer that the report called for by paragraph (b) is due but has not been received, or if received, is found to be unsatisfactory. No amount shall be withheld under this paragraph when the minimum amount specified by this paragraph is being withheld under other provisions of this contract. The withholding of any amount or subsequent payment thereof to the Contractor shall not be construed as a waiver of any right accruing to the Government under this contract.

SPECIFICATIONS

PART III -- SPECIAL CONDITIONS

SC-01. COMMENCEMENT, PROSECUTION AND COMPLETION.- (a) The Contractor will be required to commence work under this contract within 10 calendar days after the date of receipt by him of notice to proceed, to prosecute said work with faithfulness and energy and to complete the entire work ready for use, not later than 840 calendar days after the date of receipt by the Contractor of notice to proceed. The time stated for completion shall include final clean-up of the premises.

(b) When all work under the contract is completed except mulching, fertilizing, and seeding, and such work is not performed because of seasonal limitations as stated in paragraph 17-02 or because of conditions occuring within the specified seeding seasons, which in the opinion of the Contracting Officer, are unfavorable for such work, the time for completion will be extended by the number of calendar days that the mulching, fertilizing and seeding work is thereby delayed. In the event the mulching, fertilizing and seeding or any portion thereof is eliminated from the contract in accordance with the provisions of paragraph SW-03 or 17-02, the time allowed for completion of the contract as stated in paragraph SC-01(a) above will not be affected by such elimination.

SC-02. LIQUIDATED DAMAGES.- In case of failure on the part of the Contractor to complete the work within the time fixed in the contract or any extensions thereof, the Contractor shall pay the Government as liquidated damages the sum of $300.00 for each calendar day of delay until the work is completed or accepted.

SC-03. VARIATIONS IN ESTIMATED QUANTITIES.- Quantity Items Nos. 1, 2, 3, 4, 6, 7, 8, and 33 are of such a nature that they may vary from the estimated quantities shown in the contract. Should the actual quantity of work performed under any of these items vary from the estimated quantity by more than 20%, a contract modification will be issued adjusting the estimated quantity and the estimated contract price, and an adjustment in the unit price for that item may be made on the following basis:

Where the actual quantity of work for an item exceeds by more than 20% the estimated quantity stated in this contract for such item, either party to this contract may make a demand for negotiation for a new unit price for the actual quantity of work that is in excess of the estimated quantity plus 20% thereof. Where the actual final quantity of work for an item is less than the estimated quantity stated in the contract by more than 20% the Contractor will be paid at the contract unit price for that item for the actual quantities of work performed and, in addition, may request compensation in an amount sufficient to provide a reasonable allowance for the loss of indirect costs on the quantity of work represented by the difference between the actual quantity and the estimated quantity of work less 20% thereof. In the event of a dispute as to the amount of any adjustment under this paragraph, the matter shall be treated as a question of fact to be determined in accordance with the "Disputes" clause of this contract.

SC-04. PAYMENTS.- (a) Under the contract to be entered into under these specifications such work as may be done subsequent to June 30, 1957, or in excess of the amount for which funds are available for payment as herein set forth, will be continued with funds to be hereafter appropriated.

(b) From funds heretofore appropriated, the sum of $1,155,000 has been initially allotted and will be reserved for payments in connection with this contract, including all cost of superintendence and inspection and all collateral and incidental expenses in connection therewith. Of this sum the amount of about $1,095,000 is available for payment of the Contractor's estimates.

(c) If at any time it becomes apparent to the Contracting Officer that the balance of this allotment and reservation is in excess of the amount required to meet all payments due and to become due the Contractor because of work performed and to be performed until June 30, 1957, and for all supervisory, collateral, and incidental expenses in connection therewith until that date, the right is reserved after due notice to the Contractor to reduce said allotment and reservation by the amount of such excess.

(d) If the rate of progress of the work is such that it becomes apparent to the Contracting Officer that the balance of the allotment and reservation is less than that required to meet all payments due and to become due to the Contractor because of work performed and to be performed until June 30, 1957, and for all supervisory, collateral, and incidental expenses in connection therewith until that date, the Government may allot and reserve additional funds for payments under this contract if there be funds available for such purposes. The Contractor will be advised of any additional allotment so made.

(e) It is expected that prior to June 30, 1957, Congress will make additional appropriations applicable to work under this contract, but as to this it must be distinctly understood and agreed that the Government is in no case to be made liable for damages in connection with this contract on account of delay in payments on same due to a lack of available funds. Should it become apparent to the Contracting Officer that the available funds will be exhausted before additional funds are appropriated, the Contracting Officer will give 30 days written notice to the Contractor that work may be suspended; but, if the Contractor so elects, he may continue work under the conditions and restrictions of the specifications, after the time set by such notice, so long as there are funds for inspection and superintendence, with the understanding, however, that no payment will be made for such work until additional funds shall have been provided in sufficient amount. When funds again become available, the Contractor will be notified accordingly. Should work be thus suspended, additional time for completion will be allowed equal to the period during which work is necessarily so suspended, as determined by the dates specified in the above-mentioned notices.

(f) So long as funds are available, payments will be made monthly in accordance with the clause of the contract entitled "Payments to Contractors." Unless otherwise authorized in writing by the Contracting Officer, the items of work for which payment will be made shall be limited to those listed and enumerated in the contract. The unit prices or lump sum price or prices stated in the contract will be used in determining the amount to be paid and shall constitute full and final compensation for all work.

(g) The procedure above described will be repeated as often as may be necessary on account of the exhaustion of available funds and the necessity of awaiting the appropriation of additional funds by Congress.

(h) Should Congress fail to provide additional funds during its regular session as expected, the contract may be terminated and considered to be completed, at the option of the Contractor, without prejudice to him, at any time not later than 30 days after payments are discontinued, or if payments have been previously discontinued, not later than 30 days after the passage of the act which would ordinarily carry an appropriation for continuing the work, or after the adjournment of Congress without passing such act.

SC-05. CONTRACT DRAWINGS AND SPECIFICATIONS.- (a) Ten sets of the contract drawings and specifications will be furnished the Contractor without charge. Additional sets will be furnished on request at the cost of the reproduction.

(b) The work shall conform to the following contract drawings entitled "Devil's Kitchen Dam, Williamson County Illinois," having subtitles and drawing numbers as listed below. These drawings form a part of these specifications and are available at the St. Louis District, Corps of Engineers Office, St. Louis, Missouri.

Sheet No.	Subtitle	Drawing No.
1	Site Plan	801.1402
2	General Plan	801.1403
3	Half Plan, Profile And Sections Monoliths I Thru X	801.1404
4	Half Plan, Profile And Sections Monoliths XI Thru XVII	801.1405
5	Details Of Training Wall And Spillway Crest	801.1406

Sheet No.	Subtitle	Drawing No.
6	Valve House Floor Plan At El. 438.0 Grating Plan And Beam Details	801.1407
7	Valve House Sections Thru 24" And 48" Valves	801.1408
8	Valve House And Dam Miscellaneous Details	801.1409
9 thru 11	Valve House Wall Reinforcement	801.1410 thru 801.1412
12	Valve House Floor And Roof Reinforcement	801.1413
13	Stilling Basin, Section Showing Drainage, South Spillway Wall And End Sill Details	801.1414
14	North Spillway Walls Reinforcement And Details	801.1415
15	South Spillway Walls Reinforcement And Details	801.1416
16	Grouting And Drainage Plan, Profile And Sections	801.1417
17	Drainage Gallery, Monolith IX	801.1418
18	Drainage Gallery, Monoliths XI, XII, And XIII	801.1419
19	Trash Rack Details	801.1420
20	Auxiliary Spillway Plan, Profile And Sections	801.1421
21	Auxiliary Spillway Typical Sections	801.1422
22	Electrical Layout, Dam Lighting	801.1423
23	Electrical Layout, Gallery Lighting	801.1424
24	Field Office Building	801.1425
25	Boring Data	801.1426

SC-06. SHOP DRAWINGS.- The Contractor shall submit to the Contracting Officer for approval six copies of all shop drawings as called for under the various headings of these specifications. These drawings shall be complete and shall contain all required detailed information. If approved by the Contracting Officer, each copy of the drawings will be identified as having received such approval by being so stamped and dated. The Contractor shall make any corrections required by the Contracting Officer. Four sets of all such shop drawings will be retained by the Contracting Officer, and two sets will be returned to the Contractor. The approval of the drawings by the Contracting Officer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory. Approval of such drawings will not relieve the Contractor of the responsibility for any errors which may exist as the Contractor shall be responsible for the dimensions and design of adequate connections, details, and satisfactory construction of all work.

SC-07. PHYSICAL DATA.- Information and data furnished or referred to below are furnished for information only and it is expressly understood that the Government will not be responsible for any interpretations or conclusions drawn therefrom by the Contractor.

(a) Physical Conditions.- The physical conditions indicated on the drawings and in the specifications are the result of site investigations by surveys, auger borings and core borings. Additional boring data are available for inspection at the St. Louis District Service Base at the foot of Arsenal Street, St. Louis, Missouri.

(b) Weather Conditions.- Information with respect to temperatures and precipitation may be obtained from the U. S. Weather Bureau.

(c) Transportation Facilities.- Railroads and highways serve the general area of the work and public roads lead to the site as indicated on the drawings.

(d) Stream Flow Data.- The drainage area above the dam site is approximately 19.3 square miles. No stream flow records on Grassy Creek are available. The following values have been obtained from observation and high water marks.

Minimum flow	0 cfs
Flood flow (Not maximum)	2,090 cfs

(e) Previous Construction.- Construction of the dam was started in 1941 under the Works Project Administration and was discontinued in February 1943, leaving the project in its present state of completion. In November 1955 the dam site was cleared of timber and brush that had grown up since 1943 and silt and gravel overlying the existing concrete surfaces were removed.

(f) Electric Power.- Electricity in the vicinity of the dam is supplied by the Egyptian Electric Cooperative Association of Steelville, Illinois, a local utility company with existing power facilities within 1/2 mile of the dam site.

(g) Water Supply.- Water for both drinking and construction purposes, for the original construction was obtained from a well approximately 335 feet deep located approximately 250 feet north of the north end of the dam. See also paragraph 2-09.

(h) Telephone Service.- Telephone service in the vicinity of the dam is supplied by the General Telephone Company of Illinois, 1428 Walnut Street, Murphysboro, Illinois. Existing telephone facilities to provide service on a one-party line basis for the Contractor and the Government are approximately six miles from the dam site.

(i) Delivery of Government-Furnished Property.- The Government-furnished property specified in paragraph SC-09 will be delivered to the Contractor at the warehouse in the Crab Orchard Wild Life Refuge approximately 15 miles from the project site.

SC-08, RATES OF WAGES.- (a) The minimum wages to be paid laborers and mechanics on this project, as determined by the Secretary of Labor to be prevailing for the corresponding classes of laborers and mechanics employed on projects of a character similar to the contract work in the pertinent locality, are as set forth below.

(b) Any class of laborers and mechanics not listed below employed on this contract shall be classified or reclassified conformably to the schedule set out below by mutual agreement between the Contractor and class of labor concerned subject to the prior approval of the Contracting Officer. In the event the interested parties cannot agree on the proper classification or reclassification of a particular class of laborers and mechanics to be used, the question, accompanied by the recommendation of the Contracting Officer, shall be referred to the Secretary of Labor for final determination.

(c) The minimum wages required to be paid to laborers and mechanics to be employed on this contract project (see paragraph (a) above) have been established as follows by decision of the Secretary of Labor (Wage predetermination No. R-3106 dated 4 September 1956).

Classification of Laborers and Mechanics	Minimum Rates of Wages Per Hour
Boilermakers	$3.35
Boilermaker's helpers	3.10
Bricklayers	3.00
Carpenters	2.50
Cement masons	2.90
Electricians	3.18
Electricians Apprentices:	
1st 6 months	40% of journeyman's rate
2nd 6 months	45% of journeyman's rate
3rd 6 months	50% of journeyman's rate
4th 6 months	55% of journeyman's rate
5th 6 months	60% of journeyman's rate
6th 6 months	70% of journeyman's rate
7th 6 months	75% of journeyman's rate
8th 6 months	80% of journeyman's rate

Classification of Laborers and Mechanics	Minimum Rates of Wages Per Hour
Ironworkers, structural	$3.15
Ironworkers, ornamental	3.15
Ironworkers, reinforcing	3.15
Laborers	2.00
Lineman	3.38
Lineman apprentices:	
1st 6 months	2.24
2nd 6 months	2.49
3rd 6 months	2.73
4th 6 months	3.00
Millwright	2.50
Painters, brush	2.50
Painters, structural steel	2.75
Plumbers	3.20
Roofers	2.00
Sheet metal workers	3.35
Steamfitters	3.20
Stonemasons	3.00
Power equipment operators:	
Crane, shovel and dragline, 4 yds. or more	3.25
Scraper, 18 yds. struck or over	3.25
Dredge and derrick	3.25
Dual drum mixer	3.25
Push boat operator	3.25
Mechanic on 4 yd. machine or over	3.25
Engine man on 4 yd. machine or over	3.25
Oiler on crane, dragline and all other machine 4 yds. or over	2.60
Standard or dinkey locomotive	3.25
Elevating grader	3.25
Crane, shovel, draglines, backhoe, skimmer scoops, backfiller, piledriver, and all machines less than 4 yds.	3.15
Oiler on crane, dragline, shovel and all machines less than 4 yds.	2.45
APSCO spreading machine	3.15
Concrete breakers	3.15
All mixers of 21 cu. ft. or over	3.15
Mechanic on small machine	3.15
Tournapull and D. W. -10 scraper	3.15
Power hand blad and motor patrol	3.15
Scraper, less than 18 yds. struck	3.15
Tractor w/bulldozer, w/pusher or w/highlift	3.15
Boom or winch cat	3.15
Bituminous mix place machine	3.15
Blacksmith	3.15
Pumpcrete pumps or concrete pump	3.15
Trenching machine and truck crane	3.15
Two well point pumps	3.15
One well point pump	2.60
Tugger type hoist	3.15

Classification of Laborers and Mechanics	Minimum Rates of Wages Per Hour
Power equipment operators: (Contd)	
Two drum (or over one drum) hoist	$3.15
Rubber-tired farm type tractor w/bulldozer or hi-lift (over 1/2 yd.)	3.15
Rubber-tired farm type tractor w/bulldozer of hi-lift (1/2 yd. or less)	2.65
Concrete finishing machine and spreader machine	3.15
Bituminous surfacing machine	2.90
All tract type tractors	2.60
All wheel type tractors	2.45
Self-propelled roller	2.90
Power subgrader	2.90
Any type tractor pulling any type roller	2.60
Form grader	2.90
Power operated bullfloat	2.90
Two heaters	2.90
All hand blades	2.90
Boom or winch truck	2.90
Motor crane oiler	2.90
One drum hoist	2.90
Cat wagon, with or without dump	2.90
Mechanic in permanent yard (Dec. 15th to April 15th)	2.90
Operator in permanent yard (Dec. 15th to April 15th)	2.80
Two conveyors	2.90
One conveyor	2.35
Two air-compressors, 220 cu. ft. capacity or over	3.15
One air-compressor, 220 cu. ft. capacity or over	2.60
Two pumps, two air compressors (under 220 cu. ft.) two welding machines, two light plants, or any combination of two of the above machines	2.60
All mixers of less than 21 cu. ft.	2.60
Fireman and switchman	2.60
Equipment greaser	2.90
One air-compressor, under 220 cu. ft. capacity	2.35
One welding machine or one light plant	2.35
One small pump	2.35
One heater	2.35
Truck drivers:	
4 wheel trucks, 5 cu. yds. and under	2.25
4 wheel trucks, over 5 cu. yds.	2.45
6 wheel trucks, 8 cu. yds. and under	2.45
6 wheel trucks, over 8 cu. yds.	2.65
Lowboy and winch trucks	2.45
Dumpcretes and scoopmobiles	2.25
Mixer trucks, 3 cu. yds. and under	2.30
Mixer trucks, over 3 cu. yds. including all half track mixer trucks	2.50

Classification of Laborers and Mechanics	Minimum Rates of Wages Per Hour
Truck drivers: (Contd)	
Koehring or similar dumpsters, track trucks, Euclids and hug bottom dump, Tournapulls, Tournatrailers, Tournarockers or similar equipment when used for transportation purposes:	
10 cu. yds. and under	$2.45
Over 10 cu. yds., up to and including 16 cu. yds.	2.65
Over 16 cu. yds.	2.85
Oil distributors, one man operation	2.85
Oil distributors, two man operation	2.50
4 wheel service trucks	2.25
Pick-up trucks	2.25
Tandem and semitrailer service trucks	2.45
Dumpsters or similar dumpsters	2.30
Fork lifts when used for transportation purposes	2.55
Pavement breakers	2.45
Air compressors and welding machines including those pulled by separate units	2.25
A-frame trucks, when used for transportation purposes	2.55
Batch trucks, 2-34-E batches or less	2.25
Batch trucks, over 2-34-E batches	2.45
Pole trailers	2.45
Teamsters, helpers and warehouse men	2.25
Mechanics (full time) when working on equipment operated by members of the Teamsters and Chauffeurs Union	2.45
Mechanics' helpers and greasers	2.25

(d) The wage rates contained in this decision are straight hourly wage rates. In some areas, management and labor organizations in the construction industry have collectively bargained for health and welfare fund contributions. Such contributions are not included in wage rates determined by the Secretary of Labor for construction projects.

SC-09. GOVERNMENT-FURNISHED PROPERTY.- The Government will furnish to the Contractor the following property to be incorporated or installed in the work or used in its performance. Such property will be furnished at the place specified in paragraph SC-07, when needed by the Contractor. The Contractor will be required to accept delivery when made, to load the property aboard his carrier and transport it to the job site at his own expense. All such property will be installed and/or incorporated into the work at the expense of the Contractor unless otherwise indicated herein. Any property so furnished which is excess upon the completion of the work shall remain the property of the Government. The Contractor shall check the quantity and condition of such Government-Furnished property when delivered to him, acknowledge receipt thereof in writing to the Contracting Officer, and in case of damage to or shortage of such property, he shall within 24 hours report in writing such damage and/or shortage to the Contracting Officer.

Quantity	Item	Description
1	*48-inch gate valve	Iron body, brass mounted flanged type manufactured by Ludlow Valve Mfg. Co.
1	*24-inch gate valve	Iron body, brass mounted flanged type manufactured by Ludlow Valve Mfg. Co.
1	*Operating stand for the 48-inch gate valve	Geared, two-speed, crank operated type manufactured by Ludlow Valve Mfg. Co.
1	*48" to 42" Reducer	Special cast iron pipe-section

*These items have been in storage since 1941 and some parts are missing or damaged. The Contractor will be required to recondition them and repair or replace any damaged or missing parts as prescribed in paragraph 6-06.

SC-10. WATER.- The responsibility shall be upon the Contractor to provide and maintain at his own expense an adequate supply of water for his use for construction and domestic consumption, and to install and maintain necessary supply connections and piping for same but only at such locations and in such manner as may be approved by the Contracting Officer. Before final acceptance, temporary connections and piping installed by the Contractor shall be removed in a manner satisfactory to the Contracting Officer.

SC-11. ELECTRICITY.- All electric current required by the Contractor shall be furnished at his own expense. All temporary connections for electricity shall be subject to the approval of the Contracting Officer. In the event electricity is made available by the Government, the Contractor shall, at his own expense, install a meter to determine the amount of current used by him and such electricity will be paid for, or charged to the Contractor at prevailing rates or at reasonable rates as determined by the Contracting Officer. All temporary lines shall be furnished, installed, connected, and maintained by the Contractor in a workmanlike manner satisfactory to the Contracting Officer and shall be removed by the Contractor in like manner at his expense prior to completion of the construction.

SC-12. PLANT.- The Contractor agrees to keep on the job sufficient plant to meet the requirements of the work. The plant shall be in satisfactory operating condition and capable of safely and efficiently performing the work as set forth in the specifications and the plant shall be subject to inspection by the Contracting Officer at all times. The following plant is the minimum which the Contractor agrees to place on the job unless otherwise determined by the Contracting Officer; its listing herein is not to be construed as an agreement on the part of the Government that it is adequate for the performance of the work.

MINIMUM PLANT TO BE USED ON THE WORK

No.	Type	Capacity	Condition

The measure of the "Capacity of the Plant" shall be its actual performance on the work to which these specifications apply.

SC-13. SPECIAL REQUIREMENTS FOR WORK IN NATIONAL WILDLIFE REFUGES.- (a) The Contractor shall comply with the Federal laws, rules, and regulations governing National Wildlife Refuges, the premises made available for work under this contract, and the activities specified herein, and with all written instructions issued by the Refuge Officer in charge.

(b) The Contractor shall take all reasonable precautions to prevent the escape of fire and to suppress the same; and he shall, to the best of his ability, render reasonable assistance in the suppression of fires occurring on the refuge.

SC-14. SAFETY REGULATIONS.- (a) Power Transmission Lines.- In construction adjacent to any power transmission lines, the Contractor will not be permitted to operate swinging equipment within 30 feet of the conductors. The type of equipment and method of construction in the vicinity of transmission lines shall be subject to the approval of the Contracting Officer. The Contractor shall construct barricades around each power transmission tower or pole at the site of the work so that no equipment can come closer than 15 feet to said towers or poles, except at those towers and poles where work under this contract must, in the opinion of the Contracting Officer, be performed closer than 15 feet. In cases where work is carried on closer than 15 feet to said tower or poles, the Contractor shall conduct all operations with the utmost precautions.

(b) Electric Blasting Caps.- Because of the danger of premature accidental explosion of electric blasting caps by radio transmitters, the Contractor shall if such caps are used, comply with controls established in accordance with recognized safe wattage distance tables and such other controls as may be directed by the Contracting Officer.

(c) Falling Rock.- Prior to starting construction operations, the Contractor shall remove from the slopes of the bluff at the dam site all loose rock and earth, and all rock and earth which threatens to be loosened through vibration. However, throughout the period of construction, he shall conduct periodic inspections of the rock walls to determine if any further loosening of the rock has occured or threatens to occur and shall immediately remove any rock which, in the opinion of the Contracting Officer, threatens to endanger the work or personnel by sliding.

SC-15. SURVEYS.- (a) Layout of Work.- (1) The Government will establish the following base lines and bench marks at the site of the work:

a. Axis of the dam.

b. Centerlines of permanent and temporary access roads and auxiliary spillway structure.

c. One bench mark near each end of the dam and one near the stilling basin.

d. One bench mark at the auxiliary spillway structure.

(2) After the award of the contract, construction cross sections for the access road and auxiliary spillway grading and for the earth dam

embankment will be furnished the Contractor, giving additional information as to grades, cross sections, dimensions and embankment and excavation quantities.

(3) From the base lines and bench marks established by the Government, the Contractor shall complete the layout of the work and shall be responsible for all meansurements that may be required for the execution of the work to the location and limit marks prescribed in the specifications or on the contract drawings, subject to such modifications as the Contracting Officer may require to meet changed conditions or as a result of necessary modifications to the contract work.

(4) The Contractor shall furnish, at his own expense, such stakes, templates, platforms, equipment, tools and material, and all labor as may be required in laying out any part of the work from the base lines and bench marks established by the Government. It shall be the responsibility of the Contractor to maintain and preserve all stakes and other marks established by the Contracting Officer until authorized to remove them, and if such marks are destroyed by the Contractor or through his negligence, prior to their authorized removal, they may be replaced by the Contracting Officer, at his discretion, and the expenses of replacement will be deducted from any amounts due or to become due the Contractor. The Contracting Officer may require that work be suspended at any time when location and limit marks established by the Contractor are not reasonably adequate to permit checking the work.

(b) Quantity Surveys.- (1) The Government will furnish all personnel, equipment and material required to make necessary original and final surveys and make such compilations as are necessary to determine the quantities of work performed or finally in place.

(2) For surveys necessary to determine the amount of progress payments, the Contractor will be required to furnish all personnel, equipment, and material required to make such surveys as are necessary to determine the quantities of work performed or placed during the period covered by the progress payments. All original field notes, computations, and other records taken by the Contractor for the purpose of progress surveys shall be furnished promptly to the representative of the Contracting Officer and shall be used to the extent necessary in determining the proper amount of progress payments due to the Contractor. Unless waived in each specific case, quantity surveys made by the Contractor shall be made under the direction of a representative of the Contracting Officer.

SC-16. WORK AREAS.- (a) In accordance with paragraph GC-04, the Contractor will be allowed free use of the Government-controlled land near the dam site, not otherwise reserved for the Contracting Officer. Any additional land required by the Contractor shall be obtained at his own expense.

(b) The Contractor shall submit for approval plans showing the arrangement of the temporary buildings, concrete plant, storage yards, roadways and other facilities which he proposes to erect on Government-controlled land.

SC-17. ACCESS.- Access to the job-site from a public road will be permitted over the access roads to be constructed or repaired under this contract, provided such roads are maintained in a condition satisfactory to the Contracting Officer at all times during the life of the contract. The Contractor will be permitted free use of the existing roads which lead to the stream bed downstream and upstream of the dam provided he maintains the said roads in a usable condition, satisfactory to the Contracting Officer, at all times during the life of the contract. The Contractor may improve the existing roads leading to the stream bed; however, such improvements shall be at the Contractor's expense. Upon completion of the contract, the road leading to the stream bed on the downstream side of the dam shall be left in a satisfactory all-weather condition.

SC-18. APPROVED AGGREGATE SOURCES.-- (a) Concrete aggregates meeting the requirements of these specifications, except as noted in subparagraph (b) next below, can be produced from the approved sources listed below:

Type of Aggregate	Name of Firm	Location
Coarse Aggregate	Anna Quarries Company	Anna, Illinois
Coarse Aggregate	Southern Illinois Stone Company	Buncombe, Illinois
Fine Aggregate	H. L. Lawder Sand Company	Grand Tower, Ill.
Fine Aggregate	Halliday Sand Company	Cairo, Illinois

Concrete aggregates may be furnished from any of the above-listed sources, or at the option of the Contractor may be furnished from any other source proposed by the Contractor and approved by the Contracting Officer. The Contractor shall designate in writing the source or sources from which he will furnish the aggregate. If the fine aggregate and coarse aggregate are not to be furnished from the same source, the Contractor shall supply coarse aggregate from one source only and fine aggregate from one source only. If the Contractor proposes to furnish aggregate from a source or from sources not already approved, he may designate only one source for both coarse and fine aggregate or one source for each. Samples for testing shall be provided as required by Section 4 of the Technical Specifications. If a source proposed by the Contractor is not approved for use as determined by the Contracting Officer, the Contractor shall furnish aggregate from an approved source listed above at no additional cost to the Government. Approval of a source of concrete aggregate is not to be construed as approval of all materials from that source. The right is reserved to reject materials from certain localized areas, zones, strata or channels, when such materials are unsuitable for concrete aggregate as determined by the Contracting Officer. Material produced from an approved source shall meet all of the grading, uniformity and particle shape requirements, of Section 4 of the Technical Provisions of these specifications.

(b) Fine aggregate normally produced at the source of supply listed above probably will require the addition and blending of fine sand in order to meet the requirements of the specifications for fines passing the No. 50 and No. 100 sieves. Tests indicate that acceptable corrective additions to remedy deficiencies in fine aggregate grading may be obtained from the following source. Such material may be provided from any other source but must be tested and approved for use as required by Section 4 of these specifications.

Type of Material	Name of Firm	Location
Admixture Sand	Guth Sand Company	Mitchell, Illinois

SC-19. CONTRACT DELAYS CAUSED BY OPERATION OF PRIORITIES AND ALLOCATIONS SYSTEM.- The Government will take no action pursuant to the clause of the contract entitled "Termination for Default - Damages for Delay - Time Extension," to terminate the right of the Contractor to proceed or to assess liquidated or actual damages where the failure of the Contractor to complete the work within the time specified elsewhere in this contract is due solely to the operations of the priorities and allocations system and is not otherwise caused by the fault or negligence of the Contractor. It is understood and agreed that such delays will be considered as due to an act of the Government and as such will be excusable within the meaning of subparagraph (c) of the aforesaid clause of the contract, and the Contractor will be entitled to a time extension by reason thereof.

SC-20. TRANSPORTATION OF EXPLOSIVES AND OTHER DANGEROUS ARTICLES.- The transportation of Class A and B explosives, Class A and B poisons and Class D radioactive material, as classified in Part 72 of ICC Regulations, shall comply with appropriate safety requirements of the Interstate Commerce Commission, even when such regulations are not mandatory under law for local transportation. This action will in no way relieve the Contractor of responsibility for compliance with all laws and regulations promulgated by Federal, State and local Governments and municipalities that are applicable to and govern each particular shipment. Inspections to insure compliance by contractors will be made of vehicles engaged in the local transportation of explosives and other dangerous articles as defined herein. Such inspections will be limited to movement within or across the boundaries of project areas, installations, etc., under Army control.

SC-21. GUARANTEES.- (a) The following listed equipment to be furnished under this contract shall be guaranteed for a period of one year from the date of acceptance thereof, either for beneficial use or final acceptance, whichever is earlier, against defective materials, design, and workmanship:

(1) Butterfly valve.
(2) Overhead crane.
(3) Each blower and motor for the ventilating system.
(4) Panelboard.
(5) Service disconnect.
(6) Circuit breakers.
(7) Switches.
(8) Receptacles.
(9) Lighting fixtures.

(b) Upon receipt of notice from the Government of failure of any part of the guaranteed equipment during the guarantee period, the affected part or parts shall be replaced promptly with new parts by and at the expense of the Contractor.

SC-22. PAYMENTS FOR PREPARATORY WORK.- (a) Part payments will be made on account of the actual expenditures made by the Contractor on preparatory work as follows: The Contractor may submit to the Contracting Officer certified accounts of the actual payments made by him for construction plant exceeding $10,000 in value per unit, as appraised by the Contracting Officer at the site of the work, acquired for the execution of the work, for the transportation of all plant to the site, for material purchased for the prosecution of the contract, but not to be incorporated in the work, and for personal services and hire of plant on work preparatory to commencing actual work on the items for which payment is provided under the terms of the contract. Accounts so submitted must be accompanied by certificate of the Contractor supported by receipted bills showing that he has acquired said construction plant and material free from all encumbrances and an agreement that it will not be removed from the site and that structures and facilities prepared or erected for the prosecution of the contract work will be maintained and not dismantled prior to the completion and acceptance of the entire work without the written permission of the Contracting Officer. If the Contracting Officer finds that said construction plant, material, and the preparatory work performed are suitable and necessary to the efficient prosecution of the contract and that the said preparatory work has been done with proper economy and efficiency, payment, less the prescribed retained percentage, will be made therefor to the Contractor as a partial payment on the items for which payment is provided in the contract; provided, however, that payment for construction plant, material and structures and facilities prepared or erected for prosecution of the contract work shall not exceed the cost thereof to the Contractor less the estimated value upon the completion of the contract as determined by the Contracting Officer, and in no event shall such payment exceed 75% of the cost thereof to the Contractor. No payment will be made in reimbursement of the premium paid on the performance bond or payment bond. The findings of the Contracting Officer as to the suitability and value of the construction plant, materials, structures or facilities shall be final.

(b) No payment for construction plant and preparatory work will be made until the Contractor has submitted, and the Contracting Officer approved, a schedule prorating said payment to the items for which payment is provided under the terms of the contract, and the payment made for construction plant and preparatory work shall be part payment for these items. In no case shall the aggregate payments for construction plant and preparatory work exceed 5 percent of the estimated aggregate consideration of the contract. Should the contract be terminated as provided in paragraph SC-04(i) because of the failure of Congress to provide additional funds for its completion, the Contractor may be permitted to remove plant and material on which payments for preparatory work have been made subject to an equitable deduction from the amounts due the Contractor to reimburse the United States for the unabsorbed value of such plant and material.

PART IV -- TECHNICAL PROVISIONS

SECTION 1 -- CLEARING AND GRUBBING

1-01. SCOPE.- The work covered by this section consists of furnishing all labor, equipment, and materials necessary to perform the clearing and grubbing of the areas specified herein or indicated on the drawings, and the removal or disposal of all cleared and grubbed materials as specified herein, and the filling of all grubbing holes.

1-02. CLEARING.- In areas where grubbing, as specified in paragraph 1-03 below, is not required the clearing operations shall consist of the complete removal of all obstructions above the ground surface.

(a) Earth Dam and Access Roads.- Except as otherwise provided in subparagraph (1) next below, all trees, stumps, down timber, snags, brush, vegetation, old piling, loose stone, abandoned structures, fencing, and similar debris shall be cleared within the limits of the earth portions of the dam and of the excavation and embankment required for the access roads and auxiliary spillway.

(1) Trees.- Certain trees, as designated by the Contracting Officer, may be left standing. Trees shall be felled in such a manner as to avoid damage to trees left standing, to the existing structures and installations, and to those under construction as well as with due regard for the safety of employees and others.

(2) Vegetation.- Vegetation to be removed shall consist of all heavy growth of crops, grass, and weeds.

(b) Concrete Dam, Riprap, and Ditches.- Clearing requirements for all areas where excavation is to be performed or upon which fill is to be placed in connection with construction at the concrete portions of the dam, and for riprap and ditches, shall be as specified in subparagraph 1-02(a) above.

1-03. GRUBBING.- Grubbing shall consist of the removal of all stumps, roots, buried logs, and other objectionable matter.

(a) Earth Dam, Earth Dike and Structures.- (1) The entire area within the foundation limits of the earth portions of the dam, of the earth dike along the auxiliary spillway, and the areas within the limits of all structures shall be thoroughly grubbed. All tap roots, lateral roots, or other projections over 1-1/2 inches in diameter within these areas shall be removed to a depth of three (3) feet below the natural surface of the ground.

(b) Access Roads, Ditches and Fills.- All stumps, exposed roots and other obstructions shall be removed from within the limits of all access roads and ditches to be constructed under this contract, and from all areas upon which fill is to be placed in connection with construction of the concrete portions of the dam. In addition, tap roots over 1/2 inch in diameter shall be removed to a depth of three (3) feet. Grubbing of unexposed lateral roots will not be required.

(c) Filling of Holes.- All holes caused by grubbing operations shall be filled in 8-inch layers, and each layer compacted to a density equal to that of the adjoining undisturbed material.

1-04. DISPOSAL OF DEBRIS.- Except as hereinafter specified, all logs, brush, slash, and other debris which are the products of the clearing and grubbing operations shall be disposed of by burning in open areas within the limits of the Contractor's work areas. The Contractor shall comply with all Federal, State and local laws and regulations, pertaining to the building of fires. Fires shall be kept under constant attention until they have burned out or been extinguished and, at no time, shall a fire be left unattended. Stumps or debris that are impracticable to burn shall be placed in the area for wasting surplus excavation. Materials so placed shall be buried with at least three (3) feet of earth cover. The top of the required earth cover shall not be higher than the surface of the adjacent fill. In lieu of disposition by burning or placement in the waste area, the Contractor, at his option, may remove any or all of the products of clearing and grubbing operations from the site and dispose of the material at other locations or through other sources arranged for, by and at the expense of the Contractor and approved by the Contracting Officer. No products of clearing and grubbing operations shall be placed in areas where they may be carried away by stream flow.

1-05. PAYMENT.- (a) Clearing, Grubbing and Disposal.- No separate payment will be made for clearing, grubbing, or disposal of timber, stumps, roots, fences, debris or other substances covered by this section of the specifications, and all costs in connection therewith shall be included in the contract price per cubic yard for "Excavation, Access Roads and Auxiliary Spillway."

(b) Excavation in Connection with Grubbing.- No separate payment will be made for any excavation in connection with grubbing operations. The refilling of holes caused by grubbing will be paid for at the contract price per cubic yard for "Embankment, Compacted, 8" Layers". Payment will be based on stump hole measurement.

SECTION 2 — GOVERNMENT FIELD OFFICE AND PROJECT SIGNS

2-01. SCOPE.- The work covered by this section consists of furnishing all plant, labor, materials, supplies and equipment and performing all work required for the construction of a Government field office building complete, including water supply, plumbing and sanitary facilities, heating, ventilating, electric service, telephone service and painting, parking area adjacent thereto and project signs all in accordance with the drawings and the requirements specified hereunder. Construction of the building and facilities specified in this section shall start within 10 calendar days after receipt of notice to proceed with work under the contract and shall be completed as soon as practicable thereafter. Upon completion, the building and service facilities shall become the property of the Government. When work under the contract is completed, the building and service facilities shall remain on the site. The Contractor shall be responsible for the care and satisfactory operation of all equipment installed in the building and the service facilities, and for maintaining the project signs and parking area and access thereto for the duration of the contract.

2-02. MATERIALS AND WORKMANSHIP.- Materials and equipment shall be of the type and kind specified, of good standard grade as approved by the Contracting Officer. Workmanship shall be first class throughout.

2-03. GENERAL CONSTRUCTION.- (a) Excavation and Backfill.- Excavation and backfill for foundations and utilities shall be performed as required for the work. Earth fill and backfill shall be thoroughly compacted. Excess excavated material shall be disposed of on the site as directed by the Contracting Officer.

(b) Foundations.- Foundation footings, walls, piers, steps and floor of laboratory shall be of concrete as shown on the drawings. Concrete shall be composed of Portland cement and locally available sand and crushed stone of the gradation and mix design as approved by the Contracting Officer. Gravel fill covered with a 1 inch thick layer of stiff grout shall be placed under concrete floor slabs, and a damp-proof membrane shall be placed between the layer of grout and floor slabs and against the adjacent foundation walls as shown on the drawings.

(c) Superstructure.- The superstructure shall be of frame construction as shown on the drawings. Framing lumber shall be No. 2 Common or better, dry and sound yellow pine or fir. All joists, studs and rafters shall be of the size and spacing indicated on the drawings. Finished flooring shall be 1-inch nominal thickness yellow pine, tongue and grooved "C" grade or better, laid on 5/8-inch exterior grade plywood subflooring or on 1" nominal No. 2 grade lumber subflooring laid diagonally, with waterproof building paper in between. Floor in toilet room shall be vinyl tile laid over finish flooring. Lumber for floor joists, sills and subflooring shall be given an approved preservative treatment. Preservative treatment shall conform to Interim Federal Specification, TT-W-00571d for "Wood Preservative: Recommended Treating Practice" using either oil-borne preservative, 6 pound retention or water-borne preservative, for use under moderate leaching conditions. Galvanized sheet metal termite shield shall be provided between foundations and sills.

(d) Exterior Walls.- Exterior walls shall be 3/4-inch drop siding, grade "C" or better applied over 1-inch diagonal sheathing with 15 lb. felt in between. Walls and ceilings shall be insulated with batt form, mineral type insulation. Full thick type (3" nominal thickness) shall be used for ceiling and standard thick type (2" nominal thickness) shall be used for walls.

(e) Exterior Millwork.- Exterior trim shall be white pine, stock pattern. Exterior door shall be white pine, 1-3/4-inches thick. Standard stock screen doors 1-1/8" thick shall be provided for exterior door openings. Screening shall be bronze or aluminum.

(f) Windows.- Sash shall be standard metal sash fitted with screens, of a type with glass divisions similar to that indicated on the drawings. Windows except the window in the toilet room, shall be glazed with "A" quality double strength clear window glass. The window in the toilet room shall be glazed with obscure glass. Screens shall be bronze or aluminum.

(g) Interior Finish.- Interior finish shall be yellow pine or equal stock pattern. Doors shall be 1-3/8" stock doors with fir panels. Interior of all outside walls above wainscot and ceilings shall be lined with 3/4 inch rigid insulation board having light colored factory paint coat on exposed side. The lower 4 feet shall be lined with 1" wood sheathing covered with 1/8-inch hardboard.

(h) Partitions.- Partitions shall be constructed of 2" x 4" studs, 16-inches on centers, lined both sides with same type of lining specified for interior of exterior walls, except that lining shall be on office side only of partition between office and laboratory, and the walls of the toilet room shall be lined with 3/8-inch plywood with exposed edges of the plywood covered with 5/16"x 1-3/4" lattice material. Cement asbestos lining 1/4" thick shall be placed on wall within the limits of 2 feet outside of furnace and furnace vent pipe.

(i) Hardware.- Hardware for all windows shall be shop primed steel. Doors shall have cylinder locks. Four keys shall be provided for each lock. Type and finish of hardware for doors shall be as shown on drawings.

(j) Roofing.- Roofing shall be asphalt strip shingles weighing not less than 210 pounds per square (100 square feet), of green slate surface. The shingles shall be laid over a layer of 30-pound asphalt saturated felt applied to the T & G roof sheathing. All flashings, gutters and conductors shall be galvanized iron.

2-04. PLUMBING.- (a) General.- The Contractor shall furnish and install in the building at the locations shown on the drawings the following fixtures complete with supply lines, vents, drain lines, and traps where necessary.

(b) Fixtures.- (1) Service Sink.- The service sink shall be of enameled cast iron, approximately 20" x 24" in overall size with integral back.

(2) Lavatory.- The lavatory shall be of enameled cast iron, of the wall hung type, with plain back, approximately 18" x 20" in size.

(3) Water Closet.- The water closet shall be free standing close coupled siphon-jet water-closet combination with open front seat without cover.

(4) Shower.- The shower shall have a prefabricated compartment with galvanized or enameled iron walls, precast receptor and be complete with curtain, soap dish and shower head.

(5) Water Cooler.- The water cooler shall be an electrically operated, mechanical air cooled, bubbler type, drinking water dispenser, having a minimum capacity of 4.75 g.p.h.

(6) Fittings.- Fittings shall be brass, chrome plated.

(c) Water Supply line from the well shall be 1" copper pipe, buried 32 inches underground, and shall run directly to the building with a 1-inch globe valve and drain installed within the building. The supply line shall rise to the area above ceiling, and be distributed with drop supplies to the fixtures. The cold and hot water shall be run in copper pipe. The hot water line shall rise from the water heater to the area above the ceiling and then be distributed to the fixtures requiring hot water in the same manner as the cold water. All piping in the unheated area shall be securely wrapped and protected against freezing. Hot water shall be supplied to the sink in the laboratory, the shower, and the lavatory.

(d) Vent and Waste Lines.- Vent lines and branch waste lines above ground shall be either standard weight galvanized steel pipe or cast iron drainage pipe with cast iron drainage fittings. The toilet, shower and sink shall be vented through roof with one common vent, 4-inch size. Vent from lavatory shall be 2-inch size, vented through roof. Vents through roof shall be properly flashed. Waste lines underground to 3 feet outside of building shall be cast iron pipe with watertight leaded joints. Traps shall be installed in the waste lines from the sink, lavatory and drinking fountain. Beyond 3 feet outside the building line, the waste line shall be 6-inches standard strength, bell and spigot, vitrified clay pipe. This pipe shall be extended to septic tank with a vent trap installed in the line 50 feet from the building.

(e) Water Heater.- An American Gas Association approved, 30 gal.capacity, L.P. Gas water heater shall be installed at the location shown on the drawings. The heater shall be provided with a cement-asbestos vent extening through the roof and properly flashed. The tank of the water heater shall be glass lined.

2-05. HEATING.- The Contractor shall furnish and install a liquid petroleum gas fired, forced warm air heating unit complete with warm air ducts and registers as shown on the drawings. The heating unit shall be a self contained package-type unit consisting of steel furnace, blower, filters, motor, and control equipment. The furnace shall have a guaranteed rating of not less than 120,000 B.T.U. output. The furnace shall be equipped with all safety devices, such as high limit control, barometric damper and safety shut off when pilot is out. Furnace shall be vented through roof with opening properly flashed. Ducts shall be of galvanized iron or aluminum, 22 gage. Registers shall be equipped with adjustable leavers or dampers. Returns shall consist of one return directly into the furnace from the office area and one return from the laboratory, as shown on the drawings. Duct work shall be rigidly braced and securely hung. Storage for liquid petroleum gas shall be placed as directed by the Contracting Officer outside of building. Tank shall be underwriters approved with a capacity of 500 gallons. All necessary piping and controls for the gas supply shall be provided. The Contractor shall maintain an ample supply of gas for use by the Government throughout the contract period.

2-06. VENTILATING EQUIPMENT.- A 52"x52" rain tight louver shall be installed at each end of the roof. The ventilator for the office space shall consist of one 36"x36" automatic louver with a 36" horizontal type propeller fan set over opening; this fan shall be rated at 4500 cfm. The ventilator for the concrete laboratory shall consist of a 24"x24" automatic louver with a 24" horizontal type propellar fan set over opening; this fan shall be rated at 3000 cfm.

2-07. ELECTRIC SERVICE.- The Contractor shall furnish and install electric service to and in the building consisting of 120/240 volt, single phase, three-wire, electric overhead service and interior electrical system with lighting distribution panel board, flexible armored or non-metallic sheathed cable, local switches and outlets as shown on the drawings. Ceiling lights shall be provided at the locations indicated. Lighting fixtures shall, unless otherwise indicated, be standard direct lighting fluorescent fixtures with reflector, hinged louver and 2-40 watt white lamps per fixture. Fluorescent lamp auxiliaries shall be in accordance with Federal Specification W-L-131. The lighting distribution panel board shall be of the circuit breaker type, conforming to Federal Specification W-P-131, Class 1, equipped with single pole 120 volt breakers for exhaust fans, furnace, lighting and duplex receptacles, and 2-pole, 240 volt breaker for the water pump. Aerial circuit to water pump shall be supported on 30', Class No. 6, c.y.p. poles with secondary rack attachments and shall be provided with weatherproof safety switch at water pump for disconnecting means. The electric service shall be furnished and installed in accordance with the requirements of the National Electrical Code. The Contractor shall be responsible for all service charges for electricity during the contract period.

2-08. TELEPHONE SERVICE.- The Contractor shall furnish a one-party (direct) line telephone and two (2) extensions thereto in the building. Locations shall be as indicated on the drawings. One-party line service is available from the General Telephone Company of Illinois; existing facilities are approximately six miles from the dam site. The Contractor shall be responsible for the initial cost to extend the telephone facilities to the dam site and the installation of the required telephones in the building. Thereafter, upon occupancy of the building by the Government personnel, all subsequent monthly service charges for telephone service shall be the responsibility of the Government. A contract for the use of the telephones shall be initiated between the Government and the telephone company.

2-09. PAINTING.- All exterior wood work and unfinished metal shall be painted one coat of titanium-lead-primer and two coats of titanium-lead-zinc paint. All interior wood work, doors, sash, and plywood in toilet shall have two coats of oil primer and one coat of semi-gloss enamel; insulation surfaces on walls, partitions and ceilings shall not be painted. The color of the interior shall be pale green and exterior finish coat shall be light gray.

All prime coats shall be white tinted as necessary to conform to the finished color. Floors shall be treated with two coats of penetrating floor sealer. Shelving and lockers shall be given a coat of penetrating natural color sealer.

2-10. WATER SUPPLY.- (a) General.- The Contractor shall recondition an existing well and furnish and install a pressure water system consisting of a water pump, pressure tank, complete with pressure gauge, valves, pipe, pipe fittings, hangers and supports and all other accessories required to complete a satisfactory pressure water system.

(b) The existing well is located approximately 250 feet north of the north end of the dam. It was drilled to a depth of 335 feet below the ground surface and supplied the construction needs during the original construction. The Contractor will be required to clean, recondition and sterilize the well for the water supply to the Government field office. The Contractor also will be permitted to utilize any surplus supply from the well and utilize the specified pumping equipment in connection with supplying his needs, providing the needs of the Government are not jeopardized. In the event it is found to be impracticable to recondition the existing well so as to serve the purpose intended, as determined by the Contracting Officer, the Contractor will be required under a contract modification, to construct a new well and an equitable adjustment pursuant to the clause of the contract entitled "Changes" will be made as full compensation therefor.

(c) Pump.- The pump shall be an electrical motor-driven, deep well ejector pump, which shall be set at 125 feet below the ground line. The pump shall be similar and equal to No. 2-754VD-2 stage pump as manufactured by the Fairbank Morse Company and shall be furnished complete with air aspirater and well seal. The capacity shall be 245 gallons per hour with water level at 100 feet below the ground line. Pressure range shall be from 20 to 50 psi. Drop lines shall be 1-1/4" and 1" galvanized pipe. The motor shall be rated 220 volts, single phase, 60 cycle, and shall be of sufficient size to operate the pump continuously under the specified conditions. An automatic pressure switch shall be installed in the system to start the water pump when the tank pressure drops to 30 pounds per square inch and to stop the pump when the tank pressure reaches 50 pounds per square inch. The controls shall be installed in accordance with the printed instructions of the manufacturer of the equipment.

(d) Pressure Tank.- The pressure tank shall have a capacity of 80 gallons. The tank shall be equipped with a drain plug; pressure gauge with a range from 0 to 100 pounds; sight gauge and the automatic control equipment specified in the preceding paragraph.

2-11. SANITARY WASTE DISPOSAL.- Sanitary waste shall be disposed of by means of an approved septic tank installed underground outside of the building at the location shown on the drawings. The septic tank shall have a capacity of 1000 gallons. The influent line from the building to the septic tank shall be of vitrified clay sewer pipe. The effluent shall discharge into a leaching pool consisting of 100 feet of 4" farm tile laid over a 1-foot deep gravel bed.

2-12. PUMP BUILDING.- An insulated frame building 6 feet by 6 feet by 8 feet high set on a concrete foundation, of similar construction to the office building, shall be constructed for housing the pump equipment. The building shall be heated with an electric heater of 2 KW capacity, to thermostatically control temperature to 40 degrees, supplied with 220 volt single phase, 60 cycle service.

2-13. PARKING AREA.- The Contractor shall construct a crushed stone surfaced parking area adjacent to the Government field office and an access road thereto from the adjacent existing gravel road. The surfacing shall be of the type specified in Section 16. The parking area shall be adequate for parking 12 motor vehicles as approved by the Contracting Officer and the access road thereto shall have a surfaced area 20 feet wide.

2-14.- PROJECT SIGNS AND MARKERS.- (a) Project Signs.- The Contractor shall construct and erect 4 project signs: one near the project itself; one on Illinois State Highway No. 13 at the junction of the access road leading therefrom to the dam site, about 7-1/4 miles north northwest of the dam site; one on the Giant City State Park road at the junction of the access road leading therefrom to the dam site, about 3-1/4 miles west of the dam site; and one on Illinois State Highway No. 37, at the junction of the access road leading therefrom to the dam site, about 7 miles east of the dam site. Right-of-way and permission to construct the signs will be obtained by the Government. The exact locations of the signs will be established in the field by the Government.

The project signs shall be approximately 4 feet by 5 feet in size, with face constructed of nominal 1" by 6" tongue and groove lumber backed with 1" by 6" battens, or 3/4 inch thick exterior grade plywood, inclosed in suitable built-up frame. All lumber shall be neatly joined and securely fastened. Signs shall be double-faced type so as to be read from opposite directions. Each sign shall be supported by two 6" x 6" posts set in ground. Signs will identify the project, and contain the words, "U. S. Army, Corps of Engineers, St. Louis District," the identification of cooperating agency, the name of the Contractor and the Engineer Castle. The layout and size of lettering and Castle will be given the Contractor by the Government. The background of signs shall be white; lettering shall be black, except the words "U. S. Army, Corps of Engineers" and the Castle which shall be red. The background shall be given three coats of lead and oil paint and lettering shall be done by an experienced letterer. The construction of the signs and the lettering thereon will be subject to the approval of the Contracting Officer.

(b) Direction Signs.- Direction signs, giving name of project and direction arrow, shall be installed on those access roads leading to the project site which are mentioned in paragraph (a) above, at road intersections, to direct the public to the site.

(c) The Contractor shall maintain all signs as required throughout the duration of the contract.

2-15. PAYMENT.- (a) Government Field Office and Project Signs.- Payment for furnishing all material, labor, plant and equipment, and performing all work required for the construction of the Government field office building complete, including painting; furnishing and installing service facilities including plumbing, heating, ventilating, electric and telephone services, water supply and sanitary waste disposal; housing for well pump, maintaining service facilities in a satisfactory operating condition for the duration of the contract, and for furnishing and maintaining the project and directional signs for the duration of the contract will be made at the contract lump sum price, for "Government Field Office And Project Signs."

(b) Parking Area and Access.- Measurement and payment for the surfacing and maintenance of parking area and access thereto, including the grading therefor, will be made as specified in paragraphs 16-09 and 16-10 of Section 16.

SECTION 3 -- EXCAVATION, FILL AND BACKFILL FOR STRUCTURES, CARE OF WATER, AND REMOVAL OF CONCRETE

3-01. SCOPE.- The work covered by this section of the specifications consists of furnishing all plant, labor, equipment and materials and performing all operations in connection with the excavation, care of water, removal of existing concrete, filling, and backfilling required for the construction of the concrete dam including stilling basin and the auxiliary spillway, all as shown on the drawings and hereinafter specified.

3-02. EXCAVATION.- (a) General.- The Contractor shall perform all excavation of every description and of whatever substance encountered to the lines, dimensions and elevations indicated on the drawings or as otherwise required to permit the installation of the structures and all work incidental thereto. The excavation payment lines shown on the drawings are established for the determination of payment quantities only and are not intended to represent the actual limits of required excavation. Where unsuitable foundation material is encountered at or below the elevations specified or indicated on the drawings, excavation shall be carried to such elevations or spread to such extent as ordered by the Contracting Officer. After completion of excavation, and prior to construction of the structures, the excavation will be inspected by the Contracting Officer to insure that suitable foundations or depths have been established. Care shall be taken not to excavate below the depths indicated on the drawings, unless otherwise specified or directed by the Contracting Officer. Where the excavation is made below the foundation elevations indicated on the drawings or specified or directed by the Contracting Officer, the excavation shall be restored to the proper elevation in accordance with the procedure described for tamped fill and backfill in paragraph 3-07(b), or the depths of walls or footings shall be increased as directed by the Contracting Officer, all at the expense of the Contractor. Excavation shall extend a sufficient distance from walls and footings to allow for forms, installations of adjoining work and for inspection, except where concrete for walls and footings is authorized to be deposited directly against excavated surfaces.

(b) Disposal of Excavated Material.- Excavated material suitable for fill and backfill shall be stockpiled for later use. Stockpiles shall be placed at a sufficient distance from the edge of the excavation to avoid overloading, and to prevent slides, cave-ins or damage to existing facilities. Rock and other excavated material which, in the opinion of the the Contracting Officer, is unsuitable for reuse as fill or backfill, and all surplus material shall be removed from the site and wasted in locations as shown on the drawings or directed by the Contracting Officer.

(c) Shoring.- The Contractor shall do all shoring required in performing the prescribed excavation. Shoring shall be constructed in accordance with the safety requirements of the Accident Prevention Clause of the contract, and as prescribed by the Contracting Officer.

(d) Shale.- All shale surfaces on or against which concrete is to be placed shall be kept moist from the time of exposure until the concrete is placed thereon.

3-03. CLASSIFICATION OF EXCAVATION.- (a) Classification.- Excavation for structures will be classified as "earth excavation" and "rock excavation". The structure excavation for the auxiliary spillway covered in this section of the specifications is limited to the excavation required to construct the concrete and stone protection features of the spillway. Other excavation required for the auxiliary spillway is covered in Section 14.

(1) Earth Excavation.- Earth excavation shall include the removal of all materials which can be removed without systematic drilling and blasting, such as clay, silt, sand, gravel, hard pan, loose shale, and loose stone. Boulders and detached pieces of rock nine (9) cubic feet or less in volume will be classified as earth excavation.

(2) Rock Excavation.- Rock excavation shall include all ledge and bedrock in place which requires systematic drilling and blasting. All boulders and detached pieces of rock larger than nine (9) cubic feet in volume will be included in this classification.

3-04. ROCK EXCAVATION REQUIREMENTS.- All necessary precautions shall be taken to preserve the rock outside the lines of excavation in a sound condition. Blasting shall be done only to the depth and extent approved by the Contracting Officer, with explosives of such quality, power and in such locations as will, in the opinion of the Contracting Officer, neither crack, damage or disturb the foundation or the existing concrete which is to remain in place. Hand excavation may be required to insure that sound foundations are provided. Any rock removed outside the limits of the structure foundations or below the final excavation lines indicated on the drawings, or such modifications thereof as ordered by the Contracting Officer, shall be replaced with concrete at the expense of the Contractor. Excavations in rock shall be worked and finished off to a firm solid bed free of loose and disintergraded rock.

3-05. REMOVAL OF EXISTING CONCRETE.- Existing concrete in the dam structure shall be removed to the extent indicated on the drawings or ordered by the Contracting Officer. The concrete may be removed by any methods which, in the opinion of the Contracting Officer, will not crack or otherwise damage the concrete to remain in place. Blasting shall be used only to the extent approved by the Contracting Officer and shall be subject to all applicable provisions of paragraph 3-04. The removed concrete shall be disposed of in an adjacent site in the pool area as ordered by the Contracting Officer.

3-06. CARE OF WATER.- The Contractor shall control the earthwork in the vicinity of the dam and auxiliary spillway so that the ground surface is properly pitched to prevent water running into the excavated areas. The Contractor also shall provide temporary embankments, diversion ditches, conduits, pumping facilities and/or such other approved facilities as may be necessary to divert and control the flow of water so as to enable all work to be done in the dry, and to prevent damage due to overflow. Water which has accumulated in the excavated area shall be removed by the Contractor.

3-07. FILL AND BACKFILL.- (a) Materials.- All fill and backfill shall be made with suitable clays and silts, free from debris, lumps, and perishable materials in quantities considered excessive by the Contracting Officer. No frozen material shall be placed as fill or backfill nor shall fill or backfill be placed upon or against frozen surfaces. All material shall be placed by methods, as hereinafter specified or as otherwise approved by the Contracting Officer. Suitable material from the structure excavation shall be used for fill and backfill. Additional materials needed to complete the required fill and backfill may be obtained from existing stockpiles of materials excavated by others during the original dam construction, and from the required excavation specified in Section 14 for the access roads and auxiliary spillway.

(b) Tamped Fill and Backfill (6" Layers).- That portion of the fill and backfill placed within 2 feet of the concrete surfaces and any fill and backfill beneath the base slab of the structures shall be placed in uniform horizontal layers not to exceed 6-inches in thickness before compaction, with each layer thoroughly compacted with approved mechanical tampers before the next succeeding layer is placed. Unless otherwise permitted by the Contracting Officer, backfill or fill shall not be placed against concrete within less than 14 days after the concrete has been placed.

(c) Fill and Backfill (8" Layers).- All fill and backfill outside the limits set forth above to be placed in the 6-inch layers, shall be placed by the compacted fill method specified in Section 13.

(d) Dressing.- The entire surface of the fill and backfill shall be brought to not less than the prescribed cross section at all points. Unreasonable roughness of surface shall be dressed out.

(e) Mulching, Fertilizing and Seeding.- After dressing, the surface of the fill and backfill designated to be seeded shall be mulched, fertilized and seeded in accordance with the provisions of Section 17.

3-08. MEASUREMENT AND PAYMENT.- (a) Earth Excavation.- (1) Main Dam.- The Contracting Officer will take cross sections of the construction area prior to beginning excavation for the structure. Excavation will be measured for payment by determining the volume in cubic yards between the ground surface as determined by the aforesaid cross sections and the excavation payment lines shown on the drawings. Excavation beyond the payment lines will not be measured for payment unless authorized in writing by the Contracting Officer. Where material is ordered by the Contracting Officer to be removed outside the payment lines shown on the drawings, such excavated material will also be measured and paid for on the basis of the measured volume of material removed. Payment for earth excavation required for construction of the main dam, including the stilling basin and derrick stone adjacent thereto measured as herebefore stated, will be made at the contract price per cubic yard for "Excavation, Earth, Main Dam" which price and payment shall constitute full compensation for excavating, stockpiling or wasting the excavated material as required, and all collateral work required to complete the excavation.

(2) Auxiliary Spillway.- Structure excavation for the auxiliary spillway will include excavation required for placement of the derrick stone and riprap adjacent thereto and will be measured for payment by determining the volume in cubic yards between the top elevation of the spillway and the excavation payment lines shown on the drawings. Excavation beyond the payment lines will not be measured for payment unless authorized in writing by the Contracting Officer. Where unsuitable material is ordered by the Contracting Officer to be removed from below the foundation elevations as shown on the drawings, such excavated material will also be measured and paid for on the basis of the measured volume of material removed. Payment for structure excavation, measured as herebefore stated, will be made at the contract price per cubic yard for "Excavation, Structure, Auxiliary Spillway," which price and payment shall constitute full compensation for excavating, stockpiling or wasting the excavated material as required, and all collateral work required to complete the excavation. Measurement and payment for all excavation, other than structure excavation, required at the auxiliary spillway is covered in Section 14.

(b) Shoring.- Shoring will not be measured for payment nor paid for separately, but all costs connected with its use shall be included in the applicable contract unit prices for "Excavation, Earth, Main Dam" and "Excavation, Structure, Auxiliary Spillway."

(c) Rock Excavation.- Rock excavation will be measured for payment purposes as the volume in cubic yards enclosed between the top surface of the rock and the bottom and sides of the structures or the excavation payment lines as shown on the drawings or ordered by the Contracting Officer. Payment for the rock excavation, measured as herebefore stated, will be made at the contract price per cubic yard for "Excavation Rock" which price and payment shall constitute full compensation for all costs of drilling, blasting, breaking, removal and disposal of the rock, and all collateral work required to complete the rock excavation.

(d) Concrete Removal.- The volume of existing concrete removal as required, will be measured for payment by the cubic yard on the basis of actual measurements made in the field. Where lines and elevations for removal of concrete are shown on the drawings, the measurement will be limited to those lines and elevations or such modifications thereof as ordered by the Contracting Officer. Payment for concrete removal measured as herebefore stated, will be made at the contract price per cubic yard for "Removal, Old Concrete", which price and payment shall constitute full compensation for the removal and disposal of all existing concrete specified or ordered to be removed.

(e) Tamped Fill and Backfill.- Tamped fill and backfill will be measured for payment purposes as the volume enclosed between the outer surfaces of the concrete structures and lines parallel to and 2 feet outside of the said surfaces, plus the volume enclosed within the excavation lines beneath the structure foundations. Backfill of excavation below the lines and grades shown on the drawings for the bottom of the excavation will not be measured for payment unless such additional excavation was authorized by the Contracting Officer. Payment for tamped backfill, measured within the above stated limits, will be made at the contract price per cubic yard for "Fill and Backfill, Tamped, 6" Layers" which price and payment shall constitute full compensation for removing the materials from the stockpiles, hauling, placing, compacting and all other costs incidental thereto. Backfill of areas below structure foundations where unsuitable materials are ordered by the Contracting Officer to be replaced with earth backfill will also be paid for at the contract price per cubic yard for "Fill and Backfill, Tamped, 6" Layers".

(f) Fill and Backfill Other Than Tamped.- Fill and backfill other than the tamped fill and backfill specified in subparagraph (e) next above, which is placed within the finished embankment lines and grades shown on the drawings or such modification thereof as directed by the Contracting Officer will be paid for at the contract price per cubic yard for "Embankment, Compacted, 8" Layers," which price and payment shall constitute full compensation for all costs of excavating the materials from stockpiles, hauling, placing, compacting and dressing the fill and backfill. Fill and backfill beyond the excavation payment lines shown on the drawings will not be paid for unless such excavation was authorized by the Contracting Officer.

(g) Care of Water.- Payment for the care of water will be made at the contract lump sum price for "Care of Water", which price and payment shall constitute full compensation for all costs of labor, material and equipment required to provide and maintain the excavated areas in a dry condition during construction and for the prevention of damage due to overflow.

SECTION 4 -- CONCRETE

4-01. SCOPE OF THE WORK.- The work covered by this section consists of furnishing all material and equipment and performing all labor for the manufacture, forming, transporting, placing, finishing, and curing of concrete in the structures included in these specification.

4-02. COMPOSITION.- (a) Concrete shall be composed of portland or portland-blast furnace slag cement, water, fine and coarse aggregate, and an air-entraining admixture.

4-03. QUALITY.- The concrete mixtures will be designed by the Contracting Officer who will determine the required quality and consistency of the concrete for the structures covered by these specifications.

4-04. CEMENT.- (a) General.- Cement shall be furnished in bulk except that cement necessary for finishing, grouting and patching may be packaged. For any work in which the volume of concrete is too small to justify the necessary facilities for the handling and storage of bulk cement, cement may be furnished in cloth or paper bags.

(b) Type.- Cement shall conform to the provisions of one of the following types:

(1) Portland Cement.- Conforming to Federal Specification SS-C-192a, for "Cements, Portland," Type II, Low Alkali, including the heat of hydration requirement at 7 days.

(2) Portland-Blast Furnace Slag Cement conforming to Federal Specifications SS-C-197, for "Cements, Portland, Blast-Furnace Slag", Type I S except that the following limits for the applicable characteristics shall apply:

	TYPE I S
Compressive strength, Minimum p s i :	
3 days	850
7 days	1600
Heat of Hydration, Maximum cal./g:	
7 days	70
28 days	80
Fineness:	
Residue on 325 sieve, maximum % . . .	15
Blaine Fineness Meter: Sq Cm./g.	
Average Value: Minimum	2800
Minimum Value: Any one sample	2600

(c) Test Requirements.- Cement will be sampled at the mill and stored in sealed bins pending completion of testing and shipment. Cement will also be sampled at the site of the work when determined necessary. All sampling and testing will be by and at the expense of the Government. Twenty-eight day tests for cement will be waived. No cement shall be shipped until notice has been given that the test results are satisfactory and all shipments will be made under supervision of the Government. Unsealing and resealing of bins and sealing of railroad cars and other conveyances used for shipment will be done by or under the supervision of the Government. Cars or other conveyances will not be accepted at the site of the work unless received with all seals intact. If cement is damaged in shipment, handling or storage, it shall be promptly removed from the site of the work. Cement which has been in storage at the project site over four (4) months shall not be used until retest proves it to be satisfactory.

(d) Transportation of Bulk Cement.- When bulk cement is not unloaded from primary carriers directly into weathertight hoppers at the batching plant, transportation from the railhead, mill, or intermediate storage to the batching plant shall be accomplished in adequately designed weathertight trucks, conveyors, or other means which will protect the cement completely from exposure to moisture.

(e) Storage.- Immediately upon receipt at the site of the work, cement shall be stored in a dry, weathertight and properly ventilated structure. All storage facilities shall be subject to approval and shall be such as to permit easy access for inspection and identification. Storage shall be provided at the site for at least 1500 barrels of cement. Sufficient cement shall be in storage to complete any lift of concrete started. In order that cement may not become unduly aged after delivery, the Contractor shall use any cement which has been stored at the site for 60 days or more before using cement of lesser age.

(f) Temperature of Cement.- The temperature of the cement, as delivered to storage at the site, shall not exceed 150 degrees F.

(g) Source.- The Contractor shall notify the Contracting Officer of the mill or mills from which the cement will be obtained at least 45 days in advance of the time when concrete placing is expected to begin. If cement is to be obtained from more than one mill, the notification shall state the estimated amount of cement to be obtained from each mill and the proposed schedule of shipments.

4-05. AIR-ENTRAINING ADMIXTURE.- (a) General.- The air-entraining admixture shall be any approved substance or compound which will produce entrained air in the concrete as hereinafter specified. The air-entraining admixture shall be added to the batch in solution in a portion of the mixing water. This solution shall be batched by means of a mechanical batcher capable of accurate measurement and in such a manner as will insure uniform distribution of the admixture throughout the batch during the specified mixing period.

(b) Tests.- The admixture proposed for use shall be selected 45 days in advance of the time concrete placing is started and the Contractor shall provide satisfactory facilities for the ready procurement of adequate test samples. All tests for the evaluation and approval of an admixture will be made by and at the expense of the Government. The suitability of an air-entraining admixture for use will be based on tests prescribed in, and shall meet the requirements of, Corps of Engineers "Handbook for Concrete and Cement," Serial No. CRD-C 13. An air-entraining admixture which has been in storage at the project site for longer than 6 months or which has been subjected to freezing shall not be used until retest proves it to be satisfactory.

4-06. AGGREGATES.- (a) Composition.- Fine aggregate shall consist of natural sand, manufactured sand, or a combination of natural and manufactured sands. Coarse aggregate shall consist of crushed stone.

(b) Sources and Evaluation Testing.- Aggregates shall be produced from the approved sources listed in paragraph SC-18 or from another source if approved in accordance with paragraph SC-18 and the technical provisions herein. If the Contractor proposes to furnish aggregates from a source not previously approved, the Government will make such tests and other investigations as necessary to determine whether or not aggregates meeting the requirements of these specifications can be produced from the proposed source. The tests to which the aggregate will be subjected will include specific gravity, absorption, Los Angeles abrasion, soundness in magnesium sulfate, petrographic analyses, freezing and thawing in concrete, alkali-aggregate reaction, organic impurities, and any other tests that are necessary to demonstrate that concrete of acceptable quality can be produced from the materials proposed. Suitable samples for quality evaluation from a source not previously approved shall be taken under the supervision of the Contracting Officer in accordance with Corps of Engineers "Handbook for Concrete and Cement," Serial No. CRD-C 100 and shall be delivered to a point designated by the Contracting Officer within 15 days after date of notice to proceed.

(c) Samples for Mix Designs.- Samples of the aggregates, representative of the materials approved for use in the work, shall be taken under the supervision of the Contracting Officer in accordance with the Corps of Engineers "Handbook for Concrete and Cement," Serial No. CRD-C 100 and delivered to a point designated by the Contracting Officer by the Contractor at his expense at least 60 days in advance of the time when the placing of concrete is expected to begin. Mix design studies and tests will be made by the Government and at its expense.

(d) Production Sampling and Testing.- During construction, aggregates will be sampled as delivered to the mixer to determine compliance with specification provisions. The Contractor shall provide facilities as may be necessary for the ready procurement of representative test samples. The Government will obtain and test such samples at its expense using appropriate Corps of Engineers and ASTM test methods. Tests and analysis of aggregates at various stages in the processing and handling operations will be made at the discretion of the Contracting Officer.

(e) Processed Aggregates.- Aggregates, as delivered to the mixers, shall consist of clean, hard, and uncoated particles. Where required, dust shall be removed from the coarse aggregates by adequate washing. The aggregates shall conform to the following specific requirements:

(1) Grading.-

a. Fine Aggregate.- The grading and uniformity of the fine aggregate shall conform to the following requirements as delivered to the mixers:

Sieve Designation, U. S. Standard Square Mesh	Percentage by Weight Passing
No. 4	95-100
No. 8	80-90
No. 16	55-75
No. 30	30-60
No. 50	12-30
No. 100	3-10

In addition to the grading limits shown above, the fine aggregate, as delivered to the mixer, shall have a fineness modulus of not less than 2.40 or more than 2.90. The grading of the fine aggregate shall also be controlled so that the fineness moduli of at least nine of ten test samples of the fine aggregate as delivered to the mixer shall not vary more than 0.15 from the average fineness modulus of all samples previously taken. The fineness modulus shall be determined by dividing by 100, the sum of the cumulative percentages retained on U. S. Standard Sieves Nos. 4, 8, 16, 30, 50 and 100. At the option of the Contractor, fine aggregate may be separated into two or more sizes or classifications, but the resulting combined sand shall be of uniform grading within the limits specified above,

b. Coarse Aggregate.- The grading of the coarse aggregate within the separated size groups shall conform to the following requirements as delivered to the mixer:

Sieve Size U. S. Standard Square Mesh	Percent by Weight Passing Individual Sieves		
	No. 4 to 3/4 In.	3/4 In. to 1-1/2 In.	1-1/2 In. to 3 In.
4 in.			100
3 in.			90-100
2 in.		100	20-55
1-1/2 in.		90-100	0-10
1 in.	100	20-45	0-5
3/4 in.	90-100	0-10	
3/8 in.	30-55	0-5	
No. 4	0-5		

(2) Particle Shape.- The shape of the particles in the fine aggregate and in the coarse aggregate shall be generally spherical or cubical. The quantity of flat and elongated particles in the separated size groups of coarse aggregate, as defined and determined by Corps of Engineers "Handbook for Concrete and Cement," Serial No. CRD-C 119, shall not exceed 25 percent in any size group.

(f) Storage.- Aggregates shall be stored at the site of the work in such manner as to prevent the inclusion of foreign materials in the concrete. Sufficient aggregate shall be maintained at the site at all times to permit continuous placement and completion of any lift of concrete started.

(g) Moisture Control.- All fine aggregate and the smallest size group of the coarse aggregate shall remain in free-draining storage at the site for at least 72 hours immediately prior to use.

4-07. WATER.- Water used in mixing and curing concrete shall be fresh, clean, and free from injurious amounts of sewage, oil, acid, alkali, salts, or organic matter, as determined by Corps of Engineers "Handbook for Concrete and Cement," Serial No. CRD-C 400. The source of water proposed for use will be subject to the approval of the Contracting Officer.

4-08. PROPORTIONING OF CONCRETE.- (a) Control.- The proportions of all material entering into the concrete shall be as directed. The proportions will be changed whenever such change is determined necessary to maintain the standard of quality required for the structures covered by these specifications and to meet the varying conditions encountered during construction.

(b) Measurements.- All material entering into the concrete shall be mechanically measured by weight, except the air-entraining admixture which may be measured by volume.

(c) Cement Content.- The cement content of the concrete for the various parts of the structure will range from an approximate minimum of 3 to an approximate maximum of 6 bags per cubic yard, depending on the size, type, and gradation of aggregate used, and on the structural requirements. A higher cement content will be required for the concrete facing and the exterior portions of the mass concrete than for the interior portions of the mass concrete.

(d) Aggregate Content.- The amount and maximum size of aggregate to be used in the various parts of the structure shall be as directed. Concrete mixes will be designed to use the largest size and maximum amount of coarse aggregate available and placeable in the various parts of the structure. In general, the maximum size of coarse aggregate to be used in the various parts of the work will be in accordance with the following:

LOCATION	DESIGNATED LARGEST SIZE
Item No. 10, "Concrete, Mass"	3-inch
Item No. 11, "Concrete, Facing"	3-inch
Item No. 12, "Concrete, Parapet Walls, Valve House, Stilling Basin and Training Walls"	1-1/2-inch
Item No. 13, "Concrete, Auxiliary Spillway"	1-1/2-inch

(e) Entrained-air Content.- The total calculated air content of that portion of the concrete containing aggregate smaller than the 1-1/2-inch square mesh sieve shall be between 4 and 7 percent of the volume of the concrete based on measurements made on concrete immediately after discharge from the mixer. The quantity of air within this range shall be as directed and shall be changed whenever such change is determined necessary to meet the varying conditions encountered during construction.

(f) Water Content.- The water content of all concrete mixtures will be the minimum necessary to properly place the mixture being used.

4-09. BATCHING AND MIXING.- (a) Type of Plant.- The Contractor shall provide a semi-automatic batching plant and concrete mixing equipment having a capacity of at least 400 cubic yards in 8 hours. The term "Semi-automatic" shall be defined as follows:

(1) Batch weights set manually.

(2) Mixes changed manually.

(3) Materials batched automatically

(b) Batching Plant.-

(1) Location.- The batching plant shall be located at the site of the work at a location approved by the Contracting Officer.

(2) Arrangement.- Separate bins or compartments shall be provided for fine aggregate, for the different sizes of coarse aggregate and for bulk cements when used. The compartments shall be of ample size and so constructed that the materials will be maintained separated under working conditions. Aggregates may be weighed in separate weigh batchers with individual scales, or cumulatively in one weigh batcher on one scale. Bulk cement shall be weighed on a separate scale in a separate weigh batcher. Water may be measured by weight or by volume. Batching controls shall be so interlocked that a new batching cycle cannot be started until all batchers are completely empty. The plant shall be arranged so as to facilitate the inspection of all operations at all times. Suitable facilities shall be provided for obtaining representative samples of concrete for uniformity tests. Delivery of materials from the batching equipment shall be within the following limits of accuracy:

Material	Percent
Cement	1
Water	1
Aggregate	2
Air-entraining admixture	3

(3) Water Batcher and Dispenser for Admixture.- Equipment for batching water and the air-entraining admixture shall be provided at the batching plant.

a. Water Batchers.- A suitable water measuring device shall be provided which will be capable of measuring the mixing water within the specified requirements for each batch. The mechanism for delivering water to the mixers shall be such that leakage will not occur when the valves are closed. The filling and discharge valves for the water batcher shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed.

b. Dispenser.- A suitable device for measuring and dispensing the air-entraining admixture shall be provided. The device shall be capable of ready adjustment to permit varying the quantity of admixture to be batched. The dispenser for air-entraining admixtures shall be interlocked with the batching and discharging operations of the water so that the batching and discharging of the admixture will be automatic.

(4) Moisture Control.- The plant shall be capable of ready adjustment to compensate for the varying moisture contents of the aggregates, and to change the weights of the materials being batched.

(5) Scales.- Adequate facilities shall be provided for the accurate measurement and control of each of the materials entering each batch of concrete. The accuracy of the weighing equipment shall conform to the applicable requirements of Federal Specification AAA-S-121b for such equipment. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring device. Periodic tests shall be made in the presence of a Government inspector in such a manner and at such intervals as may be directed. Upon completion of each check test and before further use of the indicating, recording or control devices, the Contractor shall make such adjustments, repairs or replacements as may be required to secure satisfactory performance. Each weighing unit shall include a visible springless dial which shall indicate the scale load at all stages of the weighing operation, or shall include a beam scale with a beam balance indicator which will show the scale in balance at zero load and at any beam setting. The indicator shall have an over and under travel equal to at least five percent of the capacity of the beam. The weighing equipment shall be arranged so that the plant operator can conveniently observe all dials or indicators.

(6) Recorders.- Not more than two accurate recorders shall be provided. The recorders shall conform to the following detailed requirements:

a. Each recorder shall be housed in a cabinet which shall be capable of being locked.

b. One recorder shall produce a printed or autographic record on a single visible chart or tape of the weights of all of the aggregates as batched and after the batcher is discharged (return to zero reference).

c. One recorder shall produce a printed or autographic record on a single visible chart or tape of the weight of the cement as batched and after the batcher has been discharged (return to zero reference). The weight or volume of water shall likewise be recorded if batched at a central batching plant.

d. The charts or tapes shall clearly indicate the different types of mixes used by stamped letters, numerals, colored ink or by other suitable means. The charts or tapes shall be so marked that variations in batch weights of each type of mix can be readily observed.

e. The charts or tapes shall show time of day (stamped or pre-printed) at intervals of not more than 15 minutes.

f. The recorded charts or tapes shall become the property of the Government.

g. The recorders shall be placed in a position convenient for observation by the plant operator and Government inspector.

(7) Protection.- All weighing, indicating, recording and control equipment shall be protected against exposure to dust and weather.

(c) Mixers.- Tilting type mixers will be required. The mixer shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixing time for each batch after all solid materials are in the mixer drum, provided that all of the mixing water shall be introduced before one-fourth of the mixing time has elapsed, shall be as follows:

Capacity of Mixer	Mixing Time
2 and 3 cubic yards	2 minutes
4 cubic yards	2-1/2 minutes

The mixing periods specified are predicated on proper control of the speed of the rotation of the mixer and of the proper introduction of the materials into the mixer. The mixing time will be increased when such increase is necessary to secure the required uniformity and consistency of the concrete or when test samples of concrete taken from the front, center, and back of the mixer show a difference of more than ten percent in the sand-cement or water-cement ratio. Mixers shall not be charged in excess of the capacity recommended by the manufacturer on the name plate. Excessive over-mixing requiring additions of water will not be permitted. Should any mixer at any time produce unsatisfactory results, its use shall be promptly discontinued until it is repaired.

(d) Batch Counter.- The mixer or mixing plant shall include a device for automatically counting the total number of batches of concrete mixed.

4-10. CONVEYING.- Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation, or loss of ingredients. There shall be no vertical drop greater than five (5) feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Belt conveyors, chutes, or other similar equipment will not be permitted for conveying concrete.

4-11. PLACING.- (a) General.- Concrete shall be worked into the corners and angles of the forms and around all reinforcement and embedded items without permitting the material to segregate. Concrete shall be deposited as close as possible to its final position in the forms. Placing of concrete shall, as far as practicable, be done by means of bottom-dump buckets. The design of the buckets shall be such that the ratio of the area of the clear gate opening or gate throat opening is not less than one-third (1/3) the area of the top charging opening. The design of the bucket shall also provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position. The depositing of concrete shall be regulated so that the concrete may be effectively compacted with a minimum of lateral movement into horizontal layers approximately twenty (20) inches in thickness. Not more than four (4) cubic yards may be deposited in one pile for compaction. The surfaces of construction joints shall be kept continuously wet for at least twelve (12) hours immediately prior to placing concrete. Free water shall be removed prior to placement of mortar and additional concrete. All approximately horizontal surfaces shall be covered by a layer of mortar of the composition directed. Concrete shall then be placed immediately upon the fresh mortar. All concrete placing equipment and methods shall be subject to approval. Concrete placement will not be permitted when, in the opinion of the Contracting Officer, weather conditions prevent proper placement and consolidation.

(b) Time Interval Between Mixing and Placing.- Concrete, shall be placed within thirty (30) minutes, after it has been mixed, unless otherwise authorized.

(c) Placing Temperature.- Concrete, when deposited in the forms, shall have a temperature of not less than 40 degrees F nor more than 60 degrees F. Heating of the mixing water or aggregates will not be permitted until the temperature of the concrete has decreased to 45 degrees F. The materials shall be free from ice, snow, and frozen lumps before entering the mixer. Cooling of the mixing water and/or aggregates shall be as required to produce specified temperatures. All methods and equipment shall be subject to approval.

(d) Concrete on Earth Foundations.- Earth foundation upon which concrete is to be placed shall be clean, damp, and free from frost, ice, and standing or running water. Prior to placing concrete the earth foundation shall have been satisfactorily compacted in accordance with the provisions of Section 2.

(e) Concrete on Rock Foundations.- Rock surfaces upon which concrete is to be placed shall be clean, free from oil, standing or running water, ice, mud, drummy rock, coatings, debris, loose, semidetached or unsound fragments. Faults or seams shall be cleaned to a satisfactory depth and to firm rock on the sides. Immediately before concrete is placed, all rock surfaces shall be cleaned thoroughly by the use of high velocity air-water jets, wet sandblasting or other approved methods. All devices necessary to produce a foundation free of running or standing water shall be installed by the Contractor and securely fastened in place so as to prevent their being jarred loose by concrete placement. All rock surfaces shall be kept continuously wet for at least twenty-four (24) hours immediately prior to placing concrete thereon. All approximately horizontal surfaces shall be covered, immediately before the concrete is placed, with a layer of mortar of the composition directed.

(f) Concrete on Existing Concrete Surfaces.- Existing surfaces of concrete, placed by others prior to award of this contract, on or against which concrete is to be placed shall be cleaned thoroughly to the satisfaction of the Contracting Officer by the use of wet sand blasting supplemented by high velocity air water jets, and/or other approved methods as required. Exposed reinforcing bars shall be straightened and cleaned of dirt, loose flaky rust and scale, oil, and grease, or cut off as determined by the Contracting Officer. Holes for anchors and additional reinforcing bars shall be drilled as required and the anchors and bars installed and grouted in place as approved by the Contracting Officer. The horizontal surfaces shall be covered, immediately before new concrete is placed, with a 1/2 inch layer of mortar of the composition directed.

(g) Lift in Concrete.- The depth of concrete placed in each lift will be as determined by the Contracting Officer. In general 10 foot lifts will be required for the concrete facing and 5 foot lifts for the mass concrete, except that near the top of the structure, 7-1/2 foot lifts will be permitted. All concrete shall be deposited in approximately horizontal layers about (20) twenty inches in thickness unless otherwise specifically authorized or directed. The placement shall be carried on at such a rate that the formation of cold joints will be prevented. Slabs shall be placed in one lift unless otherwise authorized or directed. In walls, lifts including door, window or other openings shall terminate at the top and bottom of the openings and other lifts shall terminate at such levels as will conform to architectual details. A minimum of one hundred and twenty (120) hours shall elapse between the placing of each successive lift. The maximum differential height between adjacent monoliths shall be limited to a height of three lifts unless otherwise specifically approved.

(h) Vibration of Concrete.- Concrete shall be compacted with mechanical vibrating equipment supplemented by handspading and tamping. In no case shall vibrators be used to transport concrete inside the forms. The vibrating equipment shall be of the internal type and shall at all times be adequate in number of units and power of each unit to properly consolidate all concrete. Form or surface vibrators shall not be used unless specifically approved. Internal vibrators shall maintain a speed of not less than 6,000 impulses per minute when submerged in the concrete. The intensity (amplitude) of vibration shall be sufficient to produce satisfactory consolidation. The duration of vibration shall be limited to that necessary to produce satisfactory consolidation. The manipulation of the concrete adjacent to the surface of a lift in connection with completing lift placement shall be the minimum necessary to produce the required consolidation. Excessive surface working will not be permitted. Cobbles and coarse gravel protruding from the surface of the lift shall be "walked down" into the mass during the initial vibrating operations.

(i) Placing Concrete through Reinforcement.- In placing concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs. On the bottom of beams and slabs, where the congestion of steel near the forms makes placing difficult, a layer of mortar of the composition directed shall be first deposited to cover the surface to a depth of approximately one (1) inch.

(j) Placing Concrete in Ogee Crest and Spillway Buckets.- The unformed portion of the ogee crest and spillway bucket which is to be finished shall be carried slightly above grade and struck off to grade by accurately screeding. Screeding may be accomplished by semimechanical devices or by a mechanical screed which consolidates and screeds the surface in one operation. Ribs embedded in the fresh concrete as guides for screeds will not be permitted.

4-12. CONSTRUCTION JOINT TREATMENT.- (a) General.- As a lift is completed, the top surface shall be immediately and carefully protected from any condition that will adversely affect the hardening of the concrete.

(b) Cleaning.- Horizontal construction joints on lifts with relatively open and accessible surfaces shall be prepared for receiving the next lift by cleaning with either wet sandblasting or by air-water cutting; however, approved wet sandblasting equipment shall be provided. If the surface of a lift is congested with reinforcing steel, is relatively inaccessible, or, if for any other reason it is considered undesirable to disturb the surface of a lift before it has hardened, surface cutting by means of air-water jets will not be permitted and the use of wet sandblasting will be required.

(1) Air-water Cutting.- Air-water cutting of a construction joint shall be performed at the proper time. The surface shall be cut with a high-pressure air-water jet to remove all laitance and to expose clean, sound aggregate, but not so as to undercut the edges of the larger particles of aggregate. The air pressure used in the jet shall be one-hundred (100) p s i plus or minus ten (10) p s i and the water pressure shall be just sufficient to bring the water into effective influence of the air pressure. After cutting, the surface shall be washed and rinsed as long as there is any trace of cloudiness of the wash water. The surface shall again be washed with an air-water jet just prior to placing the succeeding lift. Where necessary to remove accumulated laitance, coatings, stains, debris, and other foreign material, wet sandblasting will be required immediately before placing the next lift to supplement air-water cutting.

(2) Wet Sandblasting.- When employed in the preparation of construction joints, wet sandblasting shall be performed immediately before placing the following lift. The operation shall be continued until all unsatisfactory concrete, and all laitance, coatings, stains, debris, and other foreign materials are removed. The surface of the concrete shall then be washed thoroughly to remove all loose material.

(3) Waste Disposal.- The method used in disposing of waste water employed in cutting, washing and rinsing of concrete surfaces shall be such that the waste water does not stain, discolor, or affect exposed surfaces of the structures. Methods of disposal will be subject to approval.

4-13. EXPANSION, CONTRACTION AND VERTICAL CONSTRUCTION JOINTS.- (a) General.- Joints shall be provided at the locations indicated on the drawings and according to the details shown or as otherwise approved. The methods and materials used shall be subject to approval and the materials shall conform to Federal Specifications wherever applicable. In no case shall any fixed metal, embedded in concrete, be continuous through an expansion or contraction joint.

(b) Bituminous Mastic.- Bituminous cement, indicated on the drawings as "bituminous mastic," shall be placed in the joints where shown. The bituminous cement shall conform to Federal Specification SS-C-153 for "Cement; Bituminous, Plastic," and shall be spread evenly over the surface to the required thickness. The bituminous cement shall be placed at least 24 hours prior to the placement of adjacent concrete.

(c) Expansion Joint Filler.- Where indicated on the drawings, expansion joint filler shall be installed using preformed bituminous fiber type joint filler conforming to Federal Specification HH-F-341a for "Filler, Expansion Joint, Preformed, Nonextruding And Resilient Types (For Concrete)," Type I, Class B.

(d) Vinyl Waterstops.- (1) General.- Vinyl waterstops conforming to the provisions of subparagraphs (2) and (3) below, shall be installed in the joints where indicated on the drawings. All waterstops shall be installed so as to form a continuous watertight diaphragm in each joint. Adequate provision shall be made to support and completely protect the waterstops during the progress of this work. The Contractor shall replace or repair, at his expense, any waterstops punctured or damaged before final acceptance of the work.

(2) Materials.- The material for the waterstops shall be a polyvinyl chloride plastic having physical characteristics meeting the following requirements:

Physical Test	Test Value	Test Method
Hardness Durometer A	65-70	ASTM D 676-55T
Tensile Strength p.s.i.	1200 (Min.)	Fed. Spec. ZZ-R-601a II-5
Modulus p.s.i @ 100% Elongation	400 (Min.)	Fed. Spec. ZZ-R-601a II-5
Ultimate Elongation	300% (Min.)	Fed. Spec. ZZ-R-601a II-5
Brittleness Temperature	-30° C (Max.)	ASTM D 746-55T

(3) Construction.- The waterstops shall be manufactured with an integral cross section, which will be dense, homogeneous, and free from pitting, blisters, porosity and other imperfections. Waterstops shall be furnished in lengths as long as practical. Splices shall be made in accordance with the recommendations of the manufacturer as approved by the Contracting Officer.

4-14. FINISHING.- (a) General.- Immediately after removal of forms, all unsightly ridges or lips shall be removed and undesirable local bulging on the surfaces to be permanently exposed shall be remedied. Excessive rubbing of formed surfaces will not be permitted. Voids and holes left by the removal of tie rods in all permanently exposed surfaces and surfaces to be exposed to water shall be reamed and completely filled with dry-patching mortar (preshrunk) mixed in the proportions directed. The cement used in the mortar shall be a blend of portland cement and white portland cement properly proportioned so that the final color of the cured mortar will be the same as the color of the surrounding concrete. Defective concrete shall be repaired by cutting out the unsatisfactory material and placing new concrete which shall be secured with keys, dovetails or anchors. Concrete for patching shall be drier than the usual mixture and shall be thoroughly tamped into place. All finishing, filling of voids and tie rods holes and patching of exposed surfaces shall be performed immediately after the forms are removed, unless otherwise authorized or directed. All floors and exposed horizontal surfaces of the valve house and galleries shall have a cork float finish. All other unformed surfaces of concrete that are not to be covered by additional concrete or backfill, shall have a wood float finish without additional mortar. All surfaces shall be true to elevation as shown on the drawings. Care shall be taken to see that all free water which has accumulated at the surface is removed before making any finish. Other surfaces shall be brought to the specified elevation and left true and regular. Where indicated on the drawings, joints shall be carefully made with a jointing tool, the size and type of which shall be approved by the Contracting Officer. Every precaution shall be taken by the Contractor to protect finished surfaces from stains or abrasions. Surfaces or edges likely to be injured during the construction period shall be properly protected.

(b) Unformed Surfaces.- The type of finish required on unformed surfaces will be as indicated in paragraph (a) next above. Floating shall be started as soon as the screeded surface has stiffened sufficiently to permit floating and shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Floating may be performed by use of hand or power-driven equipment. Surfaces shall be sloped for drainage where shown on the drawings or directed.

(c) Surface Irregularities.- Surface irregularities of a floated finish shall not exceed one-quarter (1/4) inch as measured with a ten (10) foot template.

4-15. CURING AND PROTECTION.- (a) General.- All concrete shall be cured for a period of not less than fourteen (14) consecutive days by an approved method, or combination of methods. The Contractor shall have all equipment needed for adequate curing and protection of the concrete on hand and ready to install before actual concrete placement begins. The curing medium and method, or the combination of mediums and methods, used shall be approved in writing. The curing medium shall be applied so as to prevent loss of moisture from the concrete for the duration of the entire curing period. Unhardened concrete shall be protected from heavy rains and flowing water. All concrete shall be adequately protected from damage. No fire or excessive heat shall be permitted near or in direct contract with concrete at any time. All galleries, and other formed openings through the concrete shall be closed during the entire construction period.

(b) Moist Curing.- All concrete herein, except as specifically excepted in subparagraph 4-15(c), Membrane Curing, shall be moist-cured by maintaining all surfaces continuously (not periodically) wet for the duration of the entire curing period. Water for curing shall be clean and free from any elements which will cause staining or discoloration of the concrete. The source of the curing water shall be approved in writing. Where forms of wood lagging are used and left in place during curing, the lagging shall be kept wet at all times. Horizontal construction joints and finished horizontal surfaces cured with sand shall be covered with a minimum uniform thickness of two (2) inches of sand which shall be kept continuously saturated during the entire curing period. All concrete shall be protected from the direct rays of the sun during the first three (3) days of the curing period.

(c) Membrane Curing.- At the option of the Contractor, concrete in the following structures or portions of structures may be cured with an approved pigmented curing compound of the surface membrane type in lieu of moist curing with water:

Interior of galleries and
Interior of valve house.

The pigmented curing compound shall conform to Corps of Engineers "Handbook for Concrete and Cement," Serial No. CRD-C 300. The curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. The surfaces shall be thoroughly moistened with water and the curing compound applied as soon as free water disappears. The curing compound shall be applied to unformed surfaces as soon as free water has disappeared. The curing compound shall be applied in a 2-coat continuous operation by approved power-spraying equipment and at a coverage of not more than two-hundred (200) sq. ft. per gallon for both coats. The second coat shall be applied to overlap the first coat in a direction at approximately right angles to the direction of the first application. Concrete surfaces which are subjected to heavy rainfall within three (3) hours after the curing compound has been applied shall be resprayed by the method and at the coverage herein specified. All concrete surfaces, on which the curing compound has been applied, shall be adequately protected for the duration of the entire curing period from pedestrian and vehicular traffic and from any other cause which will disrupt the continuity of the curing membrane.

(d) Cold Weather.- The air and forms in contact with the concrete shall be maintained at temperatures above forty (40) degrees for at least the first five (5) days and at a temperature above freezing for the remainder of the specified curing period. The temperature protection equipment, the curing water and the removal of forms shall be handled in such a manner that the surface concrete will not be subjected to a temperature differential of more than twenty-five (25) degrees F, as determined by observation of ambient and concrete surface temperatures indicated by suitable thermometers furnished by the Government and installed outside of the concrete and two (2) inches inside the surface of the concrete. The installation of the therometers shall be made by the Contractor at such locations as may be directed. Concrete, permitted to be cured with curing compounds, shall be provided the same protection against freezing and low temperatures as provided herein for moist-cured concrete. Curing compounds shall not be used on concrete surfaces which are maintained at curing temperature by the use of free steam.

4-16. FORMS AND FORMED SURFACES.- (a) General.- Forms shall be true to line and grade within allowable tolerances for concrete surfaces, mortartight and sufficiently rigid to prevent objectionable deformation under load. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface so as to obtain accurate alinement of the surface and to prevent leakage of mortar. Responsibility for their adequacy shall rest with the Contractor; however, the type, shape, size, quality, and strength of all materials of which the forms are made shall be subject to specific approval. Bolts and rods used for internal ties shall be so arranged, that when the forms are removed, metal will be not less than two (2) inches from any concrete surface. Wire ties will not be permitted where the concrete surface will be exposed to weathering and where discoloration will be objectionable. All forms shall be so constructed that they can be removed without damaging the concrete. All exposed joints, edges, and external corners shall be chamfered and dummy chamfers and false joints shall be used to provide a neat and uniform appearance, unless otherwise directed or indicated on the drawings.

(b) Surface Finish Requirements.- The class of finish required for the vaious surfaces of the structures shall be as specified on the drawings. Allowable irregularities are designated "abrupt" and "gradual" for purposes of providing tolerances. Offsets resulting from displaced, misplaced or mismatched forms, or sheathing, or by loose knots in sheathing, or other similar form defects, shall be considered "abrupt" irregularities. Irregularities resulting from warping, unplaneness and similar uniform variations from planeness, or true curvature, shall be considered "gradual" irregularities. "Gradual" irregularities will be checked for conformance with the prescribed tolerances by means of five-foot templates composed of a straight edge for plane surfaces, or a "shaped" template for curved and warped surfaces. The requirements for the classes of finish specified on the drawings and for the types of form materials permitted for each class shall be as indicated below:

(1) Class "A" Finish.- Where Class "A" finish is specified, the sheathing shall be composed of well-matched tight fitting tongue and groove lumber. The tongue and groove lumber shall conform to the American Lumber Standards For No. 1 Boards. If necessary, the tongue and groove sheathing shall be sanded to remove imperfections and provide a form surface which will

produce a concrete surface meeting the following tolerances: "Abrupt" irregularities shall not exceed 1/8 inch. "Gradual" irregularities shall not exceed 1/4 inch in five (5) feet determined in the specified manner.

(2) Class "B" Finish.- Where class "B" finish is specified, the sheathing may be composed of tongue and groove lumber, shiplap, plywood, concrete form board, or steel. Steel lining on wood lagging will not be permitted. Tongue and groove and shiplap, when used, shall conform to the American Lumber Standards For No. 2 Boards. Plywood used for sheathing or lining shall be Grade B-B, exterior or better, as described in the commercial standards of the Douglas Fir Plywood Association. The sheathing shall provide a surface which will produce a concrete surface meeting the following tolerances: "Abrupt" irregularities shall not exceed 1/4 inch and "gradual" irregularities shall not exceed 1/2 inch in five (5) feet determined in the specified manner.

(3) Class "C" Finish.- Where class "C" finish is specified, the sheathing may be of either tongue and groove lumber conforming to the American Lumber Standards For No. 1 Boards, plywood conforming to the commercial standards of the Douglas Fir Plywood Association, or laminated (two course) wood lagging. Wood lagging for curved or warped surfaces shall be composed of splines of lumber conforming to the American Lumber Standards For No. 1 Boards, which can be bent to the required shape without splitting or cracking to form a smooth tight form. Where necessary, laminated forms shall be sanded to meet required tolerance in surface irregularities and to obtain the required shape. The sheathing shall provide a surface which will produce a concrete surface meeting the following tolerances: "Abrupt" irregularities shall not exceed 1/4 inch for irregularities parallel to direction of flow of water nor 1/8 inch for irregularities not parallel to the direction of flow of water. "Gradual" irregularities shall not exceed 1/4 inch in five (5) feet measured in the prescribed manner.

(4) Class "D" Finish.- Where class "D" finish is specified, the sheathing may be of wood, or steel, or may be steel lined. "Gradual" and/or "abrupt" irregularities shall not exceed 1 inch.

(c) Construction Tolerances.- Variation in alinement, grade and dimensions of the structures from the established alinement, grade and dimensions shown on the drawings shall be within the tolerances specified in the following tables:

(See table on Page 4.17)

TABLE I

CONSTRUCTION TOLERANCES FOR REINFORCED CONCRETE CONSTRUCTION

(1) Variation from the plumb:	In 10 feet	1/4 inch
a. In the lines and surfaces of columns, piers, walls and in arrises	In any story or 20 feet maximum	3/8 inch
	In 40 feet or more	3/4 inch
b. For exposed corner columns, control-joint grooves, and other conspicuous lines	In any bay or 20 feet maximum	1/4 inch
	In 40 feet or more	1/2 inch
(2) Variation from the level or from the grades indicated on the drawings:	In 10 feet	1/4 inch
a. In floors, ceilings, beam soffits, and in arrises	In any bay or 20 feet maximum	3/8 inch
	In 40 feet or more	3/4 inch
b. For exposed lintels, sills, and other conspicuous lines	In any bay or 20 feet maximum	1/4 inch
	In 40 feet or more	1/2 inch
(3) Variation of the linear building lines from established position in plan and related position of columns, walls, and partitions	In any bay or 20 feet maximum	1/2 inch
	In 40 feet or more	1 inch
(4) Variation in the sizes and locations of sleeves, floor openings, and wall openings		1/4 inch
(5) Variation in cross-sectional dimentions of columns and beams and in the thickness of slabs and walls	Minus	1/4 inch
	Plus	1/2 inch
(6) Footings: a. Variation of dimensions in plan	Minus	1/2 inch
	Plus	2 inches
b. Misplacement or eccentricity	2 percent of the footing width in the direction of misplacement but not more than	2 inches
c. Reduction in thickness	Minus	5 percent of specified thickness
(7) Variation in steps: a. In a flight of stairs	Rise	1/8 inch
	Tread	1/4 inch
B. In consecutive steps	Rise	1/16 inch
	Tread	1/8 inch

TABLE II

CONSTRUCTION TOLERANCES FOR MASS CONCRETE STRUCTURES

(1)	All structures:		
	a. Variation of the constructed linear outline from established position in plan	In 20 feet	1/2 inch
		In 40 feet	3/4 inch
	b. Variations of dimensions to individual structure features from established positions	In 80 feet or more	1-1/4 inches
		In buried construction, twice the above amounts	
(2)	a. Variation from the plumb, from the specified batter, or from the curved surfaces of all structures, including the lines and surfaces of columns, walls, buttresses, vertical joint grooves, and visible arrises	In 10 feet	1/2 inch
		In 20 feet	3/4 inch
		In 40 feet or more	1-1/4 inches
		In buried construction, twice the above amounts	
	b. Variation from the level or from the grades indicated on the drawings in slabs, beams, soffits, horizontal joint grooves, and visible arrises.	In 10 feet	1/4 inch
		In 30 feet or more	1/2 inch
		In buried construction, twice the above amounts	
(3)	a. Variation in cross sectional dimensions of columns, beams, buttresses, and similar members	Minus	1/4 inch
		Plus	1/2 inch
	b. Variation in the thickness of slabs, walls, and similar members	Minus	1/4 inch
		Plus	1/2 inch
(4)	Footings for columns, walls, buttresses, and similar members:		
	a. Variation of dimension in plan	Minus	1/2 inch
		Plus	2 inches
	b. Misplacement or eccentricity	2 percent of footing width in the direction of misplacement but not more than	2 inches
	c. Reduction in thickness		5 percent of specified thickness

TABLE III

CONSTRUCTION TOLERANCE FOR PLACING REINFORCING STEEL

(1) a.	Variation of protective covering	With 2-inch cover With 3-inch cover	1/4 inch 1/2 inch
b.	Variation from indicated spacing	. . . .	1 inch

(d) Coating.- Forms for exposed surfaces shall be coated with an approved nonstaining form oil which shall be applied shortly before the concrete is placed. After oiling, surplus oil on the form surfaces and any oil on the reinforcing steel or other surfaces requiring bond with the concrete shall be removed. Forms for unexposed surfaces may be thoroughly wetted in lieu of oiling immediately before the placing of concrete, except that in freezing weather oil shall be used.

(e) Removal.- Forms shall not be removed without approval, and all removal shall be accomplished in a manner which will prevent injury to the concrete. Forms shall not be removed before the expiration of the minimum time indicated below, except as otherwise directed or specifically authorized.

Arches, including gallery and conduit roofs	144 hr
Beams and deck-type slabs	144 hr
Columns and walls (lifts 15 ft. and under)	24 hr
Columns and walls (lifts over 15 ft.)	48 hr
Mass concrete (face)	36 hr
Mass concrete (bulkhead)	48 hr

When conditions on the work are such as to justify the requirements forms will be required to remain in place for longer periods.

4-17. FURNISHING AND PLACING STEEL REINFORCEMENT.- (a) General.- The Contractor shall furnish, cut, bend, and place all steel reinforcement including rods, and structural shapes as indicated on the drawings or otherwise required. All reinforcement shall be, when surrounding concrete is placed, free from loose, flaky rust, and scale, and free from oil, grease or other coating which might destroy or reduce its bond with the concrete. Placing drawings and bar list drawings shall be furnished in accordance with paragraph SC-06 and approved by the Contracting Officer. These drawings shall clearly show all reinforcing, splices, dowels, location of construction joints, etc.

(b) Cutting and Bending.- Steel reinforcement may be mill or field bent. All bending shall be in accordance with standard approved practice and by approved machine methods.

(c) Quality.- The steel reinforcement shall be intermediate grade deformed bars conforming to the requirements of ASTM Designation A15-54 T for "Billet Steel Bars for Concrete Reinforcement."

(d) Spacing of Bars.- The spacing of bars shall be as shown on the contract drawings or as directed.

(e) Relation of Bars to Concrete Surfaces.- The minimum cover for all main reinforcement shall conform to the dimensions shown on the drawings. The dimensions, as shown on the drawings, indicate the clear distance from the edge of the main reinforcement to the concrete surface. The concrete covering of stirrups, spacer bars, and similar secondary reinforcement may be reduced by the diameter of such bars.

(f) Splicing.- All splices in reinforcement shall be as shown on the drawings. Lapped ends of bars may be placed in contact and securely wired or may be separated sufficiently to permit the embedment of the entire surface of each bar in concrete. Butt-welding of bars, in lieu of lapping, will be permitted only where structural grade steel is used. All welds shall develop the full strength of the smaller bar.

(g) Supports.- All reinforcement shall be secured in place by use of metal or concrete supports, spacers or ties, as approved. Such supports shall be of sufficient strength to maintain the reinforcement in place throughout the concreting operation. The supports shall be used in such manner that they will not be exposed or contribute in any way to the discoloration or deterioration of the concrete.

4-18. EMBEDDED ITEMS.- Before placing concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Embedded items shall be free of oil and other foreign matter such as loose coatings of rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Any air or water lines or other materials embedded in structures, as authorized construction expedients, shall conform to the above requirements and upon completion of their use shall be backfilled with concrete or mortar as directed.

4-19. MEASUREMENT AND PAYMENT.- (a) Concrete.- Measurement of concrete will be made on the basis of the actual volume of concrete within the pay lines of the structures as indicated on the drawings. Measurement of concrete placed against the sides of any excavation without the use of intervening forms will be made only within the pay lines of the structure. No deductions will be made for rounded or beveled edges or space occupied by metal work, electrical conduits or timber, nor for voids or embedded items which are either less than five (5) cubic feet in volume or one (1) square foot in cross section. Unless otherwise specified, payment for concrete will be made at the respective contract prices per cubic yard for the various items of the schedule, which price shall include the cost of all labor, materials, and the use of all equipment and tools required to complete the concrete work; except the cement, reinforcement, and embedded parts which are specified to be paid for separately. No payment will be made for concrete, as such, which is placed in structures for which payment is made as a lump sum. Bidding schedule items for concrete under this contract are as follows:

Item No. 10.- This item includes all concrete in the dam within the limits of the mass concrete as shown on the drawings. Payment therefor will be made at the contract price per cubic yard for Item No. 10, "Concrete, Mass."

Item No. 11.- This item consists of the four (4) ft. thick facing on the upstream face of existing Monoliths and will include all costs in connection with the preparation of existing concrete surfaces, drilling and grouting for anchor rods. Payment therefor will be made at the contract price per cubic yard for Item No. 11, "Concrete, Facing."

Item No. 12.- This item includes all concrete placed in the parapet walls, stilling basin, training walls, and valve house, outside of the limits of mass concrete lines shown on the drawings. Payment therefor will be made at the contract price per cubic yard for Item No. 12, "Concrete, Parapet Walls, Valve House, Stilling Basin and Training Walls."

Item No. 13.- This item includes all concrete placed in the auxiliary spillway as shown on the drawings. Payment therefor will be made at the contract price per cubic yard for Item No. 13, "Concrete, Auxiliary Spillway."

(b) Portland Cement.- The quantity to be paid for under Item No. 14, "Cement, Portland," will be the number of barrels (376 pounds net weight) of portland or portland-blast furnace slag, cement used unless specifically excepted, wasted or used for the convenience of the Contractor. The quantity to be paid for will be determined by multiplying the thoeretical batch weight of portland cement in each type of concrete used by the number of batches of concrete of the types placed within the pay lines of the structures, and dividing by 376. Payment shall be made at the contract price per barrel for the schedule item which price shall include the cost of required unloading, hauling, handling, and storage at the site of all portland cement used in the work.

(c) Reinforcement.- Measurement of reinforcing bars including anchor rods for the concrete facing, will be made on the basis of the lengths of bars placed in accordance with the approved drawings or bar schedules or as directed. The measured lengths will be converted to weights for the size of bars listed by the use of the unit weights per lineal foot contained in ASTM Designation A15-54 T, Table I. Steel in laps indicated on the drawings or required by the Contracting Officer will be paid for at the contract unit price. No payment will be made for the additional steel in laps which are authorized for the convenience of the Contractor. Furnishing and placing reinforcement bars including anchor rods for the concrete facing, will be paid for at the contract unit price per pound for Item No. 15, "Steel, Reinforcement."

(d) Vinyl Waterstops.- In computing the quantity of the waterstops, no allowance will be made for laps. Payment for any materials used in conjunction with the installation or as part of the waterstops shall be included in the contract unit price for waterstops. Payment for furnishing and installing waterstops will be made at the contract price per linear foot for Item No. 16, "Waterstops, Vinyl."

SECTION 5 -- FOUNDATION DRILLING AND GROUTING

5-01. GENERAL.- (a) Scope.- The work covered by this section of the specifications consists of furnishing all labor, plant, power, equipment and materials and performing all operations in connection with drilling drain holes; drilling, washing and pressure testing grout holes; installing grout pipes and contact grouting systems; making grout connections; furnishing, handling, transporting, storing, mixing and injecting the grouting materials; patching the finished grout holes; care and disposal of drill cuttings, waste water and waste grout; clean-up of the areas upon completion of the work and all such other operations as are incidental to the drilling and the grouting.

(b) Program.- The work contemplated consists of completing the construction of a grout curtain and a drainage curtain, commenced by others, beneath the dam, and the performance of contact grouting to seal the contact faces between concrete and adjacent vertical rock formation. The approximate locations, limits and details of the work are indicated on the contract drawings and described herein. The program shown on the drawings and described herein is tentative and is presented for the purpose of canvassing bids. The amount of drilling and grouting which actually will be required is unknown, and will be governed by conditions encountered as the work progresses. The Government reserves the right to increase by as much as 100 percent or to eliminate any part of the entire drilling and grouting program should conditions indicate this as being desirable, and the Contractor will not be allowed any increase in the unit prices bid in the schedule for drilling and grouting by reason of any changes in the amount of work or materials actually involved.

(c) Procedures.- Grouting mixes, pressures, the pumping rate and the sequence in which the holes are drilled and grouted will be determined in the field and shall be as directed by the Contracting Officer.

(d) General Requirements.- General requirements for the drilling and grouting program for the various parts of the dam are as follows:

(1) Monoliths IV, V, VI, VII & XVI (New Monoliths).-

a. Grout holes.- High pressure grout holes shall be drilled into the rock foundation and grouted from upstream of the monoliths.

b. Drain holes shall be drilled into the rock foundation, through drainage pipes embedded in the monoliths.

(2) Monoliths VIII, IX & X (Partially Constructed).-

a. Grout holes.- High pressure grout holes shall be drilled into the rock foundation and grouted from upstream of the dam.

b. Drain holes shall be extended from the gallery in monolith IX into the rock foundation under monoliths VIII, IX & X.

(3) Monoliths XI, XII & XIII (Partially Constructed)

a. Grout Holes.- Low pressure grout holes shall be drilled into the rock foundation and grouted through existing pipes embedded in the portion of the monoliths presently constructed, prior to the placement of additional concrete thereover. High pressure grout holes shall be drilled into the rock foundation and grouted from the gallery level.

b. Drain holes shall be extended from the gallery into the rock foundation under the above three (3) monoliths and adjoining monoliths X and XIV.

(4) Monoliths XIV & XV (New Monoliths).-

a. Grout Holes.- Low pressure grout holes shall be drilled and grouted 20 feet into the vertical rock faces between monoliths XIII and XIV and between XIV and XV. High pressure grout holes shall be drilled into the rock foundation and grouted thru pipes to be embedded in the monoliths.

b. Drain holes shall be drilled thru drainage pipes to be embedded in the monoliths.

(5) Stilling Basin.- Drain holes shall be drilled into the rock foundation thru the stilling basin floor and for the drainage system on each side thereof as shown on the drawings.

(6) Contact Grouting.- A contact grouting system of pipes and grouting outlets shall be installed at the vertical rock faces between monoliths XIII and XIV and between XIV and XV as shown on the drawings. After the completion of concrete placement, the contact faces between the concrete and adjacent rock formation shall be sealed by grouting. In addition, the contact faces between the existing concrete of monolith VIII and the adjacent rock formation shall be sealed by grouting, as required, with grout holes drilled on an angle from outside the limits of the completed concrete structures to the contact faces.

5-02. EQUIPMENT.- The use of internal combustion engines within dam galleries for operation of drilling and grouting equipment will not be permitted.

(a) General.- All drilling and grouting equipment used shall be of a type, capacity and mechanical condition suitable for doing the work, as determined by the Contracting Officer. The power and equipment and the layout thereof shall meet all applicable requirements of local, State, and Federal regulations and codes, both safety and otherwise.

(b) Drilling Equipment.- Standard drilling equipment of the rotary type shall be used to perform the drilling as specified in paragraphs 5-04(c) and 5-04(d). Air driven drills used in galleries shall be equipped with suitable mufflers.

(c) Grouting Equipment.- The grout plant shall be capable of supplying, mixing, stirring and pumping the grout, to the satisfaction of the Contracting Officer. The plant shall have a minimum capacity of 25 gpm of grout injected at a pressure not greater than 150 psi. It shall be maintained in first-class operating condition at all times and any grout hole that is lost or damaged due to mechanical failure of equipment or inadequacy of grout supply shall be replaced by another hole and no payment will be made for any hole so lost or damaged.

5-03. GROUTING MATERIALS.- (a) Composition.- Grout will be composed of water and cement. The grout mixes will be designed by the Contracting Officer and will be varied to meet the characteristics of each hole as determined by conditions encountered. The various materials to be furnished by the Contractor shall conform to the specifications listed in subparagraphs b, and c below.

(b) Water.- The water used in the grout shall be fresh, clean and free from injurious amounts of sewage, oil, acid, alkali, salts, or organic matter.

(c) Cement.- Cement used in grout shall conform to the requirements of Federal Specification SS-C-192a, for "Cements; Portland," Type I or II. Storage of cement shall be in accordance with Section 4. The use of bulk cement will be permitted provided the Contractor provides methods of handling, transporting, and storage that are satisfactory to the Contracting Officer, otherwise, only cement furnished in cloth or paper bags will be accepted for use in the work. A sufficient quantity of cement shall be stored at or near the site of the work to insure that grouting operations will not be delayed by shortage of cement. In the event the cement is found to contain lumps or foreign matter of a nature and in amounts which, in the opinion of the Contracting Officer may be deleterious to the grouting operations, screening through a standard 100 mesh screen may be required. No additional payment will be made for such screening.

5-04. GROUT AND DRAINAGE HOLES.- (a) General.- All holes for grouting or drainage shall be drilled at the locations, in the direction and through whatever material encountered to the depths shown on the drawings or as directed by the Contracting Officer. The first series of holes to be drilled and grouted shall be at intervals as shown on the drawings and hereinafter are referred to as primary holes. The location of secondary and succeeding series (intermediate) holes if such additional holes are required, shall be determined by the split spacing method as defined in subparagraph 5-05(a)(3). The number of grout holes shall be increased progressively, by the split spacing method as deemed necessary by the Contracting Officer until the amount of grout used indicates that the foundation is tight. The use of grease, "rod dope" or other lubricant on rotary drill rods will not be permitted. Each hole drilled shall be protected from becoming clogged or obstructed by means of a cap or other suitable device on the collar and any hole that becomes clogged or obstructed before completion of operations shall be cleaned out in a manner satisfactory to the Contracting Officer or another hole provided by and at the expense of the Contractor. That portion of holes which penetrates concrete placed in the dam under this contract, shall be formed by embedding pipes in the concrete at the time of its placement, except as indicated in paragraph 5-04(b) below.

(b) Pipe for Foundation and Contact Grouting.- All metal pipe and fittings required for constructing grout holes and contact grouting systems shall be furnished out, threaded, fabricated and embedded by the Contractor. The pipe shall conform to Federal Specification WW-P-406 for "Pipe. Steel and Ferrous Alloy (for) Ordinary Uses (Iron-Pipe Size)" Type I Class A. The fittings shall be malleable iron Type I in accordance with Federal Specification WW-P-521b for "Pipe-Fittings; Malleable Iron (Screwed) 150-pound." Pipe will be black steel of the diameter and in the locations indicated on the drawings. The pipe and fittings shall be cleaned thoroughly of all dirt, grease, oil, grout and mortar immediately before embedment. All joints shall be made up snug and the assembly held firmly in position and protected from damage or displacement while the concrete is being placed. The Contractor shall take all necessary precautions to prevent any pipe from becoming clogged or obstructed from any cause and any pipe which becomes clogged shall be cleaned out in a manner satisfactory to the Contracting Officer at the Contractor's expense. The presence of tramp metal such as nails, wire, bolts, nuts and other foreign material in the pipes through which diamond drilled holes are to be drilled shall be considered as obstructions. In the case of grout holes, the Contractor may, if he so elects, substitute diamond drilled holes through the new concrete in lieu of pipe, provided that the method proposed meets with the approval of the Contracting Officer. In the event of such substitutions no payment will be made for drilling as such, for the portion of hole where pipes could have been installed, however, payment will be made for such portion at the same contract unit price as for Item 17 b" pipe, 2-1/2" diameter, for grouting. The installation of drainage pipe through which drain holes are to be drilled is specified in Section 11.

(c) Grout Hole Drilling.- Grout holes shall be drilled into the dam foundation through pipes embedded in the concrete for this purpose, except as provided for in paragraph 5-04(b) above or where grout holes are required to be drilled into existing concrete or directly into rock. Grout holes shall be drilled with standard rotary drilling equipment. No core recovery will be required and the type bit used shall be optional with the Contractor. The minimum diameter of hole shall be 1-3/8 inches at the point of maximum penetration. Grout holes shall be drilled to the angle shown on the drawings. No hole will be drilled to a depth greater than 100 feet measured from the collar of the hole. If, as the work progresses, it is determined that holes to depths greater than indicated in the bid schedule are necessary, drilling to such greater depth will be ordered in writing by the Contracting Officer and the drilling to depths in excess of 100 feet will be paid for at a negotiated unit price. Drilling will be done in accordance with the "Stage Grouting, Split Spacing" method hereinafter described. Whenever the drill water is lost, or artesian flow is encountered, the drilling operations shall be stopped and the hole grouted before drilling operations are resumed in such hole. The grout so injected remaining in a partially completed hole shall be removed therefrom by washing or other methods before it has set sufficiently to require redrilling. Redrilling required because of the Contractor's failure to clean out a hole before the grout has set shall be performed at the Contractor's expense except that where the grout has been allowed to set by direction of the Contracting Officer, the redrilling will be paid for at the rate of 50 percent of the schedule price for drilling the grout hole.

(d) Drain Hole Drilling.- Drainage holes shall be drilled into the dam foundation, through pipes embedded in the concrete for this purpose, except where holes are required to be drilled through existing concrete or directly into rock. Drain holes shall be drilled with standard diamond drilling equipment, but no core recovery will be required and the Contractor may use coring or noncoring bits as he may elect. The minimum diameter of hole shall be 2-7/8 inches measured at the point of maximum penetration.

No Drain holes shall be drilled at the angle and to the depths shown on the drawings. Drainage holes shall not be drilled without the written approval of the Contracting Officer in any location until all adjacent grout holes within a minimum distance of 150 feet have been drilled and grouted to full depth.

5-05. DEFINITIONS AND PROCEDURES FOR DRILLING AND GROUTING.- (a) General.- The drilling and the grouting shall be done by zones, using the split spacing, stage grouting method as described herein.

(1) Zone.- A zone is a predetermined partial depth of curtain. The first zone extends 20 feet downward from the contact between the concrete and the rock. The second zone extends downward from the bottom of the first zone to the bottom of the high pressure grout zone shown on the drawings. Grouting in the first zone was substantially completed by others in the initial construction, however, the effectiveness thereof cannot be guaranteed and the Contractor will be required to perform the low pressure grouting in the first zone as indicated on the drawings, and perform such additional grouting in the first zone as necessary to provide a satisfactory grouting curtain. It is anticipated that hole spacing will be as shown on the drawings. However, these spacings will be varied in accordance with conditions encountered and as directed by the Contracting Officer. In general, all grouting in a given zone and section will be finished before work is started in the next underlying zone.

(2) Stage.- A stage is a partial or complete depth of hole within any given zone. The actual depth of a stage depends upon geologic conditions encountered in drilling. It may vary from a fraction to the full depth of the zone and is marked by the loss or gain of drill water in appreciable amounts.

(3) Split Spacing.- Split spacing is the procedure of locating an additional grout hole midway, between two previously drilled and grouted holes.

(b) Stage Grouting.- Stage grouting is a complete cycle of drilling, washing, and grouting of any portion of a hole within a given zone. It involves the placement of a grout curtain by drilling and grouting in successive operations in accordance with the following general procedure:

(1) Primary holes for foundation grouting shall be drilled to comparatively shallow depths within the first zone. The depths will be governed by the foundation conditions.

(2) The holes thus drilled shall be washed and pressure tested, and then grouted, except that when pressure testing indicates a relatively tight hole, the Contracting Officer may direct that the grouting of that hole be omitted for that stage and the hole be left open for drilling and grouting of the next stage.

(3) After the grouting of any hole, the grout within the hole shall be removed by washing or by other methods before it has set sufficiently to require redrilling.

(4) After the interval of time as specified in paragraph 5-05(d)(2), the primary holes not already drilled to the limit of the first zone shall be

drilled as directed by the Contracting Officer to additional depths no exceeding the zone limit.

(5) The primary holes thus deepened shall again be washed and pressure tested and then grouted at higher pressures as directed by the Contracting Officer.

(6) Again, the grout within the hole shall be removed as described above.

(7) The process of successively drilling primary holes to additional depths and grouting at higher and higher pressures in stages, as directed by the Contracting Officer, shall be repeated until all of the primary set of holes (see paragraph 5-04(a)) have been completely drilled and grouted to the depth of the first zone over such section of the grout curtain as may be directed by the Contracting Officer.

(8) After the primary holes in the first zone have been completed in any section as specified above, the second and succeeding series of holes, as determined by the "split spacing method," shall if required, be drilled and grouted to the depth of the first zone in like manner until the first zone of that section is completely grouted as directed.

(9) The process of successively drilling to additional depths and grouting at higher and higher pressures in stages for the first series of holes, and then for succeeding series of holes if such are required, shall be repeated for the second zone of that section. Other sections along the grout curtain shall be grouted in like manner until grouting of the foundation is completed to the satisfaction of the Contracting Officer. As the drilling and grouting work progresses, it may develop that conditions are such that all or parts of the foundation already grouted require additional grouting. In such event, the equipment shall be returned and additional holes for grouting shall be drilled and grouted as directed by the Contracting Officer and no additional allowance above the contract prices will be made for drilling and grouting such holes or for the expense of any movement of equipment necessary to the performance of such work.

(c) Washing and Pressure Testing.- Immediately before the pressure grouting of each stage of any hole is begun, the hole shall be thoroughly washed under pressure and pressure tested. All intersected rock seams and crevices containing clay or other washable materials shall be washed with water and air under pressure to remove as much of these materials as possible. If practicable, as determined by the Contracting Officer, such materials shall be ejected from one or more holes by introducing water and air under pressure into an adjacent hole. In no case shall such pressure exceed the maximum grouting pressure as directed by the Contracting Officer. All grout holes shall be tested with clean water under continuous pressure up to the required grouting pressure as directed by the Contracting Officer. All holes sufficiently tight to build up the maximum required pressure shall be washed at such pressure and the washing shall continue as long as there is any increase in the rate at which water is taken, such increase indicating that fractures are being opened by the washing operation. Open holes in which no pressure can be built up shall be washed for a period of 5 minutes, with the pump operating at full capacity, or for such period of time as fracture-filling is being removed, as evidenced by the escape of muddy water through surface openings or other grout holes.

(d) Stage Grouting Procedures.- (1) First Stage.- The Contractor shall perform the first stage, or low-pressure, shallow-curtain grouting by washing and grouting holes at locations indicated on the drawings or directed by the Contracting Officer, using the "split spacing" method described in paragraph 5-05(a)(3) if required. Before grouting is begun in any hole of a given series in any section, at least the nearest two holes in advance of each such hole in that series shall be completely drilled for the same stage and the adjacent hole completely washed to facilitate washing and flushing out of any intervening clay-filled seams, fractures, or solution channels. No hole beneath any portion of the dam shall be grouted until all concrete within 100 feet has been placed to a height not less than 10 feet above the foundation surface, unless otherwise directed by the Contracting Officer.

(2) Second Stage.- After all first stage grouting in any section has been completed, as specified above, the Contractor shall proceed, when so directed by the Contracting Officer, with second stage drilling and grouting in accordance with the procedure outlined herein but in no case shall the deepening of any hole preparatory to grouting be commenced before a minimum period of 24 hours has elapsed since completion of the previous stage grouting at that hole; nor shall second stage grouting be conducted within a distance of approximately 100 feet of any hole in which a previous stage of grouting has been completed until the grout in such previous stage hole has set for a period of 24 hours. Grouting as subsequent stages shall conform to the same requirements as to minimum time and distance.

(e) Grouting Pressures.- Grouting pressures to be used in the work will vary with conditions encountered in the respective holes and pressures used shall be as directed by the Contracting Officer. It is anticipated that pressure will range from 5 psi to 100 psi but in no event will pressures in excess of 150 psi be required.

(f) Grouting.- All pressure grouting operations shall be performed in the presence of the Contracting Officer, and shall be in accordance with the following general procedure.

(1) Grout Mixes.- Grout shall consist of cement and water. Mixes shall be in the proportions directed by the Contracting Officer who will, from time to time, direct changes to suit the conditions found to exist in the particular grout hole. The water-cement ratio by volume will be varied to meet the characteristics of each hole as revealed by the grouting operation and will range between 3.0 and 0.6; the greater part of the grout probably being placed at a ratio of about 1.0.

(2) Grout Injection.- In general, if pressure tests indicate a tight hole, grouting shall be started with a thin mix. If an open hole condition exists, as determined by loss of drill water or inability to build up pressure

during washing operations, then grouting shall be started with a thicker mix and with the grout pump operating as nearly as practicable at constant speed at all times; the ratio will be decreased, if necessary, until the required pressure has been reached. When the pressure tends to rise too high, the water-cement ratio shall be increased as may be required to produce the desired results. If necessary to relieve premature stoppage, periodic applications of water under pressure shall be made. Under no conditions shall the pressure or rate of pumping be increased suddenly, as either may produce a water-hammer effect which may promote stoppage. The grouting of any hole shall not be considered complete until that hole refuses to take any grout whatever at three-fourths of the maximum pressure required for that stage. Should grout leaks develop, the Contractor shall calk such leaks when and as directed by the Contracting Officer, the cost thereof being included in the contract price for Item No. 17 e., "Grout, Portland Cement".

If, due to size and continuity of fracture, it is found impossible to reach the required pressure after pumping a reasonable volume of grout at the minimum workable water-cement ratio the speed of the pumping shall be reduced or pumping shall be stopped temporarily and intermittent grouting shall be performed, allowing sufficient time between grout injections for the grout to stiffen. Following such reduction in pumping speed, if the desired result is not obtained, grouting in the hole shall be discontinued when directed by the Contracting Officer. In such event, the hole shall be cleaned, the grout allowed to set, and additional drilling and grouting shall then be done in this hole or in the adjacent area as directed, until the desired resistance is built up.

After the grouting of any stage of a hole is finished, the pressure shall be maintained by means of a stop-cock or other suitable device until the grout has set to the extent that it will be retained in the hole. Grout that cannot be placed, for any reason, within 2 hours after mixing shall be wasted. If such grout is mixed at the direction of the Contracting Officer or with his knowledge and consent, such wasted grout except as specified in paragraph 5-06(a) shall be paid for at the contract unit prices item 17 e, "Grout Portland Cement."

(3) Equipment Arrangement and Operation.- The arrangement of the grouting equipment shall be such as to provide a continuous circulation of grout throughout the system and to permit accurate pressure control by operation of a valve on the grout return line, regardless of how small the grout take may be. The equipment and lines shall be prevented from becoming fouled by the constant circulation of grout and by the periodic flushing out of the system with water. Flushing shall be done with the grout intake valve closed, the water supply valve open, and the pump running at full speed.

(4) Protection to Work and Cleanup.- Except as otherwise specified, no grouting will be permitted within 100 feet of installed perforated pipe or gravel filters for foundation drains. Where permitted in such locations, the Contractor shall maintain a flow of water through the drains likely to be affected, to serve as tell-tales. In case leakage of grout into drains does occur the Contractor shall immediately stop the grouting operations and shall

remove all grout from the drains affected by washing to the satisfaction of the Contracting Officer, and no separate payment will be made for such work. Such stopping of grouting operations and washing of drains shall be repeated as often as required to complete the curtain grouting. During grouting operations the Contractor shall take such precautions as may be necessary to prevent drill cuttings, equipment exhaust oil, wash water, and grout, from defacing or damaging the permanent structure. The Contractor will be required to furish such pumps as may be necessary to care for waste water and grout from his operations. The Contractor shall, upon completion of his operations, clean up all waste resulting from his operations that is unsightly or would interfere with the efficient operation of the project as anticipated by the original design. No separate payment will be made for the work required for the clean up.

(g) Records.- The Contracting Officer will keep records of all grouting operations, such as a log of the grout holes, results of washing and pressure testing operations, time of each change of grouting operation, pressure, rate of pumping, amount of cement for each change in water-cement ratio, and other data as deemed by him to be necessary. The Contractor shall furnish all necessary assistance and cooperation to this end.

(h) Communications.- When, for his own convenience, the Contractor has the individual elements of his plant so located that communication by normal voice between these elements is not satisfactory, the Contracting Officer may require him to install a satisfactory mechanical means of communication, such as a telephone or other suitable device without additional cost to the Government.

5-06. MEASUREMENT AND PAYMENT.- (a) General.- The contract prices for the various items of work and materials, as described in paragraphs 5-06(b) through 5-06(h), shall constitute full compensation for mobilizing, demobilizing and furnishing all equipment necessary to perform the drilling and grouting of the structure in accordance with these specifications; installing and grouting of contact grouting systems; all drilling, washing and pressure testing of grout holes, care and disposal of waste water and waste grout, clean-up of the site, furnishing, handling, transporting and storing of grout materials, and for furnishing all labor and supplies incidental to the work. No payment will be made for grout, or the material constituents thereof, wasted due to improper anchorage of group pipe or connections, or which is wasted due to negligence on the part of the Contractor, nor for grout which is rejected by the Contracting Officer because of improper mixing. Payment will be made at the applicable contract unit prices for materials contained in grout which are wasted, where the wasting is not due to negligence on the part of the Contractor.

(b) Mobilization and Demobilization.- The cost of assembling all plant and equipment at the site preparatory to initiating the work and for removing it therefrom when the drilling and grouting program has been completed; will be made at the established contract lump-sum price for Item No. 17a, "Mobilization and Demobilization." Sixty percent of the contract lump-sum price will be paid following completion of moving onto the site, including complete assembly in working order, of all equipment necessary to perform the required drilling and grouting operations. The remaining 40 percent of the contract lump-sum price will be paid when all equipment has been removed from the site.

(c) Drilling Grout Holes.- Drilling of grout holes will be measured for payment on the basis of the linear feet of holes actually drilled in concrete or rock, as shown on the drawings or as directed by the Contracting Officer, including all intermediate holes at locations where pipe was not installed. Payment for drilling grout holes will be made at the contract price per linear foot for Item No. 17c, "Drilling Grout Holes.", except as provided by paragraph 5-04(b) in those locations where pipe is specified.

(d) Drilling Drain Holes.- Drilling of drain holes will be measured for payment on the basis of the linear feet of holes actually drilled in concrete or rock, as shown on the drawings or as directed by the Contracting Officer. Payment for drilling drain holes will be made at the contract price per linear foot for Item No. 17d, "Drilling Drain Holes." This price is subject to the cost limitation imposed by paragraph 5-04(b).

(e) Pipe for Grout Holes and Drain Holes.- Pipe and fittings except that installed in the contact grouting systems, will be measured for payment on the basis of the linear feet installed and left in place, as shown on the drawings. Payment for such pipe and fittings remaining in the permanent work will be made at the contract price per linear foot for Item No. 17b, "Pipe 2-1/2" Diameter for Grouting."

(f) Contact Grouting Systems.- Payment for furnishing and installing the contact grouting systems for sealing the contact faces between the concrete and the vertical faces of the rock at the joints between monoliths XIII and XIV and between monoliths XIV and XV, will be made at the contract lump-sum price for Item No. 17g," Contact grouting Systems" which price shall constitute full compensation for furnishing and installing the complete piping systems, grout, outlet assemblies and anchors therefor. Grout material for sealing the contact surfaces shall be paid for as stated in paragraph (g) next below. Grout holes for sealing contact surfaces between existing monolith VIII and the adjacent vertical rock surface will be paid for at applicable contract unit prices.

(g) Placing Grout.- The operation of placing grout will be measured for payment on the basis of the number of cubic feet (94 pounds) of cement used in the grout satisfactorily placed in grout holes. Payment for placing grout in grout holes will be made at the contract price per cubic foot for Item No. 17e "Grout, Portland Cement," which price shall constitute full compensation for furnishing the cement, proportioning the mix as directed, and mixing and injecting the grout, all as specified herein or as may be directed by the Contracting Officer.

(h) Connections to Grout Holes.- All connections of the grout supply line to grout holes or to contact grouting systems found necessary for the purpose of injecting grout, as determined by the Contracting Officer, will be paid for at the contract price per connection for Item No. 17f, "Connections to Grout Holes". Payment for each such connection will be made, regardless of the amount of grout actually injected.

SECTION 6 -- PIPING, FITTINGS AND VALVES FOR OUTLETS THROUGH DAM AND FOR VALVE HOUSE

6-01. SCOPE OF WORK.- The work covered by this section consists of furnishing all plant, labor, equipment, and materials, except existing Government furnished items, and performing all operations necessary to complete the installation of all piping, fittings, valves, operating stands, flexible joints and accessories in connection with the 24-inch and 48-inch water discharge pipes through the dam, the piping system for the valve house, and the 24-inch and 42-inch outlets, therefrom, as specified herein and as shown on the drawings.

6-02. SHOP DRAWINGS.- The Contractor shall submit to the Contracting Officer for approval, shop drawings of all pipe fabrication and specials, and manufacturer's detailed drawings, catalog cuts and specifications of all equipment and standard products furnished by him, including items furnished to recondition existing equipment. The drawings shall show in detail the methods of construction, materials, capacities, ratings and such other information as may be necessary for the Contracting Officer to determine the suitability of such items. All materials referred to on shop drawings shall be described by reference to applicable standard specifications. Accessories shall be listed on shop drawings by catalog number and name of manufacturer. The shop drawings shall be submitted in accordance with the requirements of paragraph SC-06.

6-03. INSTRUCTION AND PARTS LISTS.- The Contractor shall furnish 6 sets of instruction and parts lists for the valves and operating mechanisms furnished by him, covering the operation, servicing and dismantling of the respective items.

6-04. EXISTING CONDITIONS AND GENERAL REQUIREMENTS.- (a) The 48-inch diameter steel pipe in monolith IX, extending from the present upstream face of the dam to the flanged connection with the 48-inch valve in the valve house has been installed as shown on the drawings. The Contractor will be required to extend the pipe to the new upstream face of the dam and clean and recondition the exposed portions of the existing pipe as hereafter specified.

(b) The 48-inch gate valve, the 24-inch gate valve, the floor stand for the 48-inch gate valve and the 48-inch to 42-inch reducer to be installed in the valve house are stored as stated in paragraph SC-07(i). The Contractor will be required to recondition and install these items as hereafter specified.

(c) The Contractor will be required to furnish all other items except those which exist as stated in paragraphs (a) and (b) above, and complete the installation as shown on the drawings.

6-05. PIPING.- (a) Pipe.- (1) Water Discharge and Vent Pipe.- Pipe shall be steel and shall conform to the American Waterworks Association Standard Specifications C 202-49 for "Steel Water Pipe Of Sizes Up To But Not Including 30 Inches" or C 201-50 for "Electric Fusion Welded Steel Water Pipe Of Sizes 30 Inches And Over" as applicable for the diameter specified. The pipe shall have ends prepared for field butt welding, ends fitted with flanges, or plain ends for flexible couplings as required for the particular joint. Pipe shall have a minimum wall thickness as shown on the drawings. The interior surfaces of the piping shall be cleaned, primed and coated with coal-tar enamel. The exterior portions of pipe to be embedded in earth shall be cleaned, primed and coated with coal-tar enamel and the exterior wrapped with a bonded asbestos felt wrapper. All materials and application of coal-tar enamel protective coatings shall be in accordance with the American Water Works Specifications C 203 or C 204 whichever specification is applicable. The exterior surfaces of pipe to be embedded in concrete shall be thoroughly cleaned and given an approved rust inhibiting primer. The exterior surface of all exposed piping shall be given prime and finish coats of paint as specified in Section 12.

(2) Drain Pipe.- The 6-inch drain pipe through valve house wall shall be standard weight, black, steel pipe conforming to Federal Specification WW-P-406 for "Pipe; Steel and Ferrous Alloy (For) Ordinary Uses (Iron Pipe Size)," Type I, II or III.

(b) Specials and Fittings.- Specials shall be of the same material and thickness as the pipe and fabricated as shown on the drawings, with ends to accomodate the type of joint specified for the pipe. Fittings shall be of the type shown or specified and designed for a water working pressure of 150 pounds per square inch. Specials and fittings shall receive the same type protective coating as specified for the pipe.

(c) Flexible Couplings.- Flexible couplings shall be of the gasket sleeve type, of proper diameter to fit the pipe, and shall be furnished complete with gaskets and bolts. The couplings shall be installed in such a manner as to secure permanently tight joints. Couplings shall be similar to those manufactured by the Dresser Manufacturing Division, Bradford, Pennsylvania, Style 38. For dresser type couplings, metal rings without pipe stops shall be furnished. Gaskets shall be "plain" type designed for water service without special tips or armor.

(d) Welding.- The welding of joints shall be in accordance with the recommendations of the American Welding Society. Welders shall be certified as having passed qualification tests prescribed by the National Certified Pipe Welding Bureau or by other reputable testing laboratory or agency, using procedures approved by the American Society of Mechanical Engineers or the American Welding Society. The Contractor shall require any welder to retake the tests when, in the opinion of the Contracting Officer, the work of the welder creates a reasonable doubt as to his proficiency. Tests, when required, shall be conducted at no additional expense to the Government. Recertification of a welder shall be made to the Contracting Officer only after the welder has taken and passed the required retest.

(e) Installation.- (1) General.- All piping shall be installed at the locations and to the pitch indicated on the drawings. Pipe and other parts embedded in concrete shall be held in place securely to avoid displacement during the placement of concrete. Pipe and accessories shall be handled in such a manner as to prevent damage thereto. Particular care shall be taken not to injure the pipe coatings. All pipe shall be cut accurately and squarely to the measurements shown or required. All pipe shall have burrs removed. Open ends of piping shall be closed with caps or plugs during construction unless otherwise permitted.

(2) Joints.- Field connections shall be flanged or flexible type where shown on the drawings and where not shown may be either welded or flanged, except that the 6-inch drain pipe through valve house wall shall have end threaded for connection to gate valve. Flange joints shall be faced true, match existing flanges, and be made up perfectly square and tight with composition asbestos gaskets.

(3) Field Coating.- Before assembling of mechanical joints the ends of pipe and interior of fittings shall be given a suitable protective coating. After assembly, exposed surfaces of fittings and joints shall be given a protective coating and any abrasions in pipe coatings shall be repaired. Protective coating shall conform to the applicable provisions of paragraph 6-05(a).

(f) Extending Upstream End of 48-Inch Pipe.- The bell end of the existing 48-inch pipe at the present upstream face of the dam shall be removed back to a standard 48-inch diameter cylindrical section and a new section of pipe welded thereto and extended to the new upstream face, with a bell provided at the new inlet as shown on the drawings. Concrete around the existing bell shall be carefully removed in a manner which will not injure the remaining pipe or concrete. The use of explosives will not be permitted. After the pipe is sufficiently exposed, the bell shall be cut off in a neat and workmanlike manner without damage to the pipe. The remaining edge shall be trued and squared and prepared for a butt field weld, as approved by the Contracting Officer.

(g) Reconditioning of Existing Piping.- All interior surfaces and the exposed exterior surfaces of existing piping shall be thoroughly cleaned of all rust, scale and foreign matter and be given a protective coating in the field, of the applicable type as specified in paragraph 6-05(a).

(h) Flashing at Roof Opening.- The 14-inch diameter steel vent pipe from the 42-inch line in valve house shall pass through an approved pipe sleeve cast in the roof slab and be flashed to provide a weather proof installation as approved by the Contracting Officer.

6-06. GATE VALVES AND OPERATING STANDS.- (a) Reconditioning Existing Equipment.- (1) The existing 48-inch and 24-inch gate valves to be installed in the valve house, are iron body, brass mounted, flanged gate valves manufactured by the Ludlow Valve Manufacturing Company Inc., Troy, New York, and carry their designation No. 6. The existing operating stand for the 48-inch valve, is a Ludlow, geared, two speed, crank operated, floor stand. These items have been at the job site since 1941. The bushing on top of the housing of the 48-inch valve is missing and the 4-inch brass stem of the valve has been cut off about 6 inches outside the housing and removed from the site. The 2-1/4 inch brass stem of the 24-inch valve also has been cut off about 5 inches outside the housing and removed from the site. The stem cover of the existing floor stand is also missing. The Contractor will be required to dismantle these valves and operating stand and thoroughly clean and recondition all parts, provide new brass stems, replace any missing parts and put the equipment in first class operating condition. The actual condition of the existing equipment and the extent of any missing parts other than those indicated above, are not known and the Contractor shall examine the items and determine for himself the extent of the repairs and work necessary to put them in proper working condition.

(b) Operating Stand for 24-Inch Gate Valve.- The operating stand for the 24-inch gate valve shall be new. It shall be of the hand crank operated, enclosed geared, 2-speed, pedestal type, equipped with machine cut gears and anit-friction bearings throughout. The hoisting unit shall be made of cast iron or cast steel, and be equipped with bronze stem nut and thrust bearings of the ball or roller type. The hoist shall be adequately designed to operate the valve as recommended by the valve manufacturer and as approved by the Contracting Officer. Adequate means for lubrication of the hoist shall be provided.

(c) Gate Valve For 6-Inch Drain.- The 6-inch gate valve for valve house drain shall conform to Federal Specification WW-V-58 for "Valves, Cast-Iron, Gate; 125 And 250-Pound, Screwed And Flanged (For Land Use)." Type I wedge disc, nonrising stem, screwed ends, class A (125 pound). An operating shaft with hand wheel shall be extended to the operating floor of the valve house as shown on the drawings.

(d) Erection.- The gate valves shall be connected to piping and be supported and anchored as shown on the drawings. The valves and operating stands shall be carefully fitted together so that after final assembly there will be no interference through bad alinement, or any warping or twisting of the members that would in any way interfere with smooth and satisfactory operation. All turnbuckles for holding down valves, and bolts for attaching the operating stands shall be securely tightened. Adequate provisions for lubrication of the operating mechanism shall be made and all lubricating systems shall be filled with an approved lubricant.

6-07. BUTTERFLY VALVE.- (a) Valve.- The butterfly valve on the 42-inch outlet pipe shall be new, of cast steel, class 150 pound, flanged type, with vane chrome tipped, for operation under a maximum head of 92 feet, throttling service, and free discharge, similar and equal to R-S 150 pound cast steel valve No. B8571-A as manufactured by the R-S Products Corporation, Valve Division, Philadelphia, Pennsylvania. The vane stem shall be horizontal, with reduction gears mounted on the side of valve and vertical extension to the floor stand on the operating floor. Shafts shall be corrosion resisting steel.

(b) Floor Stand.- The floor stand for the butterfly valve shall be of cast iron or cast steel, of the handwheel pedestal type, with position indicator and locking device. The unit shall have a 24-inch handwheel. The hoist shall be adequately designed to operate the valve specified against the required head as recommended by the valve manufacturer and as approved by the Contracting Officer, with not more than 40 pound pull on the handwheel. Adequate means for lubrication of the hoist shall be provided.

(c) Erection.- The butterfly valve, operating mechanism and floor stand shall be erected as shown on the drawings. The valve and operating mechanism and floor stand shall be carefully fitted together so that there will be no interference through bad alinement, or any warping or twisting of members that would in any way interfere with smooth and satisfactory operation. All bolts shall be securely tightened. Adequate provisions for lubrication of the operating mechanisms shall be provided and all lubricating systems shall be filled with an approved lubricant.

6-08. ACCESSORIES.- Sufficient hangers, braces, anchors, and supports shall be furnished and installed to adequately support and brace the valve equipment and piping assemblies. Anchors for holding down valves shall be as detailed on the drawings. Materials shall conform to the applicable provision of paragraph 7-03 of Section 7. Bolts and nuts for flange connections shall be of wrought iron conforming to requirements of Federal Specification QQ-I-686b for "Iron, Wrought (Refined); Bars," Grade A, and in other respects shall conform to the requirements of Federal Specification FF-B-571a for "Bolts; Nuts; Studs; And Tap-Rivets (And Material For Same)," Type B-1-B and B-2-A. The bolts shall be of such length that the full depth of the nut will be engaged by threads on the bolts.

6-09. TESTS AND TRIALS.- (a) Piping.- All piping covered by this section of the specifications, shall be subjected to a hydrostatic pressure of 150 pounds per square inch. Piping may be tested in sections, and pipe which is to be embedded in concrete or covered with earth shall be tested before being covered. All pipe, joints, fittings and valves shall be carefully examined during the test and any cracked or defective pipe or fittings or improper joints disclosed in the pressure test shall be replaced or corrected by the Contractor, and the test repeated until test results are satisfactory to the Contracting Officer.

(b) Valves and Operating Stands.- After final erection, each valve and operating stand shall be tested by raising and lowering or rotating the valve disc throughout its complete travel by means of its operating mechanism a sufficient number of times to demonstrate to the satisfaction of the Contracting Officer that it complies with the specifications. Any defective part or error in the construction or alinement discovered during the tests and trials shall be immediately corrected by the Contractor without cost to the Government.

6-10. PAINTING.- All exposed piping, fittings, valves, operating stands and accessories at the valve house shall be painted as specified in Section 12.

6-11. PAYMENT.- Payment for the piping, valves and fittings covered by this section of the specifications will be made at the contract lump sum price for "Discharge Pipe, Valves and Fittings." This price and payment shall constitute full compensation for all costs of plant, labor and materials, required for completing the installation of the 24-inch and 48-inch discharge pipes through the dam, installing the discharge and vent piping, valves and operating mechanisms in the valve house, installing the 24-inch pipe stub on the outside of the valve house and the 42-inch discharge outlet leading to the stilling basin and including reconditioning of existing equipment and piping, furnishing all additional new piping, valves, equipment and accessories, extending the upstream end of the 48-inch pipe as prescribed in paragraph 6-05(f) including the removal and replacement of concrete required in connection therewith, applying protective coating and conducting all tests and trials as prescribed.

SECTION 7 — STRUCTURAL STEEL, GRATINGS, HANDRAILING, OVERHEAD CRANE AND MISCELLANEOUS ITEMS

7-01. SCOPE.- (a) The work covered by this section consists of furnishing all plant, labor, equipment and materials, and performing all operations in connection with the fabrication and installation of the structural steel, gratings, handrailing, overhead crane and miscellaneous items as listed in subparagraph (b) below, complete in strict accordance with this section of the specifications and the applicable drawings.

(b) The items included in this section are as follows:

(1) Structural steel framing for valve house operating floor.
(2) Floor gratings.
(3) Ladder.
(4) Cover plates, filler and base plates and seat angles.
(5) Pipe handrailing.
(6) Removable chain guards.
(7) Intake screen, guide plates and contact plates at stop log recesses.
(8) Windows for valve house.
(9) Door frames and doors for valve house and entrance to gallery.
(10) Overhead traveling crane, manually operated.
(11) Steel pipe 8" diameter, caps and covers for inspection wells.
(12) Anchors and fasteners for above items.

7-02. SHOP DRAWINGS.- The Contractor shall prepare and submit to the Contracting Officer for approval, complete shop drawings, for all work requiring fabrication. Where materials are standard stock products of manufacturers, catalog data including specifications and full descriptive data shall be submitted for approval. Shop drawings shall be submitted in accordance with the requirements of paragraph SC-06.

7-03. METALS AND STANDARD MATERIALS.- (a) Structural Steel.- Structural steel shall conform to the requirements of Federal Specification QQ-S-741a for "Steel Plates, Shapes And Bars, Carbon, Structural" Type I, or ASTM Designation A7-55T, "Tentative Specification For Steel For Bridges And Buildings."

(b) Standard And Special Bolts.- Bolts and nuts shall conform to Federal Specification FF-B-571a for "Bolts; Nuts; Studs; And Tap Rivets (And Material For Same)." Unless otherwise specified, indicated or required, bolts shall be Type "B-2" of Class C steel, and nuts Type "A-2" of Class C steel. Fit shall be Class 3 medium fit, except that where bolts and nuts are zinc-coated, the fit before coating shall be Class 1, loose fit. Bolts and nuts shall be zinc-coated unless otherwise specified.

(c) Steel Pipe and Fittings.- (1) Steel pipe shall conform to Federal Specification WW-P-406 for "Pipe; Steel And Ferrous-Alloy (For) Ordinary Uses (Iron-Pipe-Size)," except that pressure tests will not be required. Pipe shall be Type I, Class A, Zinc-coated or black as required.

(2) Fittings shall be of standard weight, malleable iron conforming to the applicable provisions of Federal Specification WW-P-521b for "Pipe Fittings; Malleable-Iron (Screwed), 150 Pound", zinc-coated or black as required. Fittings for hand rail may be of the welded, screwed or riveted pin types, or fittings may be eliminated provided the pipe ends are shaped and welded in an approved manner, all details of which shall be indicated on shop drawings submitted in accordance with the provisions of paragraph SC-06. In event the railings are welded, black pipe shall be furnished and the railings galvanized after fabrication.

(d) Washers shall be of approved commercial standard type and quality.

(e) Anchors and Fasteners.- Anchors and fasteners not shown in detail on the drawings shall be of approved commercial standard type and manufacture as approved by the Contracting Officer.

(f) Minor materials not specified herein shall be standard commercial type and manufacture as approved by the Contracting Officer.

7-04. METAL WORKMANSHIP.- (a) General.- Finished steel members shall be free from kinks, bends, or winds. Material shall be thoroughly straightened by methods that will not result in injury, except that sharp kinks or bends in members to be straightened will be cause for rejection. Shearing shall be accurately done, and all portions of the work shall be neatly finished. Bends, except for minor details shall be made to approved dies. Where heating is required, precautions shall be taken to avoid overheating the metal and it shall be allowed to cool in such a manner as not to destroy the original properties of the metal. Corners shall be square and true unless otherwise shown on the drawings. Steel with welds will not be acceptable, except where welding is definitely specified, called for on the drawings, or otherwise approved. All bolts, nuts and screws, where required, shall be tight.

(b) Dimensional Tolerances for Structural Work.- Dimensions shall be measured by means of an approved steel tape. Unfairness of plate work shall be held to a practicable minimum. Members which are assembled to other steel parts of the structure, shall not deviate from the dimensions shown on the drawing by more than 1/16 inch.

7-05. WELDING.- (a) Welding, unless otherwise specified, shall conform to the provisions of the current AWS "Standard Code For Arc And Gas Welding In Building Construction."

(b) Welders who have not been certified within two years of date of signing the contract, will be required to pass successfully the tests as prescribed by either the American Welding Society "Tentative Standard Qualification Procedure," the U. S. Navy Department "General Specifications for Inspection of Material, Appendix VII, Welding" or U. S. Coast Guard "Marine Engineering Regulations and Material Specifications" before being assigned to production work. The Contractor shall certify by name, to the Contracting Officer, welding operators so qualified and the code under which qualified. The Contractor shall require any welder to repeat the qualifying tests, when, in the opinion of the Contracting Officer, the work of the welder indicates a reasonable doubt of his efficiency. In such cases, the welder shall be recertified, as above, if he successfully passes the re-test; otherwise he shall be disqualified until he has successfully passed a re-test. All expenses in connection with qualification and requalification shall be borne by the Contractor.

7-06. RIVETING.- Punching, drilling, reaming and riveting shall be in accordance with the best commercial practice for the type of work concerned, and as approved by the Contracting Officer.

7-07. BOLTED CONNECTIONS.- (a) Bolt Holes.- Bolt holes shall be not more than 1/16 inch larger than the nominal diameter of the bolt. Poor matching of holes shall be cause for rejection.

(b) Bolts and Nuts shall conform to the provision of paragraph 7-03(b). The finished shank shall be long enough to provide full bearing, and washers shall be used under the nuts to provide full grip when the nuts are tightened.

7-08 STRUCTURAL STEEL FLOOR FRAMING FOR VALVE HOUSE. Structural steel framing for the support of the operating floor, floor gratings and valve stands in the valve house shall be fabricated and installed as shown on the drawings. Structural connections shall be riveted and bolted as detailed on the drawings. The top of the framing members supporting the floor gratings shall be held to as true a plane as practicable.

7-09. ZINC COATINGS.- Unless otherwise specified, indicated or required, zinc coatings shall be applied in a manner and of a thickess and quality conforming to ASTM Designation A-123-53 for "Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed, And Forged Steel Shapes, Plates, Bars, And Strip." Where possible items requiring welding shall be galvanized after fabrication.

7-10. GRATINGS.- Gratings of structural steel shall be of welded construction and shall be of the sizes and fabricated in accordance with the details shown on the drawings. Edges of gratings shall be banded. Gratings shall meet the applicable requirements of Federal Specification RR-G-661a for "Gratings; Steel, Floor (Except For Naval Vessels)," Type 1, and shall be galvanized after fabrication by the hot dipped process.

7-11. INTAKE SCREEN AND GUIDE PLATES AT STOP LOG RECESS.- Intake screens shall be furnished and installed at the inlets to the 48" and 24" pipes at the upstream face of monolith No. IX as shown on the drawings. The intake screens shall be fabricated of structural steel with welded joints in accordance with the details shown on the drawings. Guide and contact plates at the stop log recesses, anchored to the concrete, shall be fabricated and installed as indicated. All parts of the intake screens and guide and contact plates shall be zinc-coated after fabrication.

7-12. PIPE RAILING.- Pipe railing shall be fabricated from steel pipe conforming to the requirements of paragraph 7-03(c), and shall be installed as shown on the drawings. Fittings for hand railing shall be standard galvanized malleable iron railing fittings as shown, or the railing assembly may be welded, at the option of the Contractor. In attaching handrailing to concrete surfaces, floor flanges shall be faced and drilled for attachment to the concrete as shown, or the Contractor may, at his option, grout the pipe uprights into recesses left in the concrete. Handrailing that is set on floor grating in the valve house shall be securely bolted thereto. In event the railing is welded, uncoated pipe shall be furnished, and then galvanized after fabrication.

7-13. LADDERS.- A fixed ladder, shall be furnished and installed in the valve house as shown on the drawings. It shall be of welded construction and fabricated of structural steel to the sizes and dimensions shown on the drawings. Ladders shall be constructed in a workmanlike manner with roughness and sharp edges removed. Anchor bolts shall be galvanized. The ladders shall be galvanized after fabrication.

7-14. REMOVABLE CHAIN GUARDS.- Removable chain guards shall be furnished and installed as shown on the drawings for protection at the ladder opening in the operating floor of the valve house. Chain, chain snaps, hitching posts and accessories shall be of approved standard commercial quality. All fabricated items shall be galvanized after fabrication.

7-15. MISCELLANEOUS METAL WORK.- Miscellaneous cover, filler and support plates, in connection with valve house floor framing and supports for valve stands; cover plate and frame over each ventilating blower recess; and a section of 8 inch diameter galvanized steel pipe with pipe cap or cover plate as indicated, at top of each inspection well at vertical joints between monoliths shall be furnished and installed as shown on the drawings. The cover plates over the inspection wells in the non overflow monoliths shall be attached to a flange at the top of the section of pipe by countersunk screws. The cover plates over ventilating blower recesses shall be attached to embedded steel angle frames by means of countersunk machine screws. The cover plate in the valve house floorway shall be held in place by an approved fastening device. Cover plate in floorway of valve house, cover plates over inspection wells and frame and cover plate over blower recesses shall be galvanized after fabrication. Machine screws shall be of approved copper alloy or stainless steel. Materials for the metal work shall conform to the applicable provisions of paragraph 7-03, or, if not covered by the aforesaid paragraph, shall be of approved standard commercial quality.

7-16. ENTRANCE DOORS.- (a) The entrance doors to the valve house and to the gallery at Monolith XIII shall be approved industrial steel paneled doors of the size and type indicated on the drawings. The doors and frames shall be properly prepared and reinforced to receive finished hardware. Frames shall be of structural steel as shown on the drawing. Doors shall be constructed of 1-3/4 inch by 5 inch tubular stiles and top and intermediate rails and 1-3/4 inch by 6 inch bottom rail, all of 16 U. S. Standard gage steel, with 18 U. S. Standard gage steel upper and lower panels. Bottom panels shall be louvered. The door frames and fittings shall be first class materials and workmanship in every way. All corners shall be mitered and welded with welds ground smooth. Doors and frames shall be given the manufacturer's standard shop prime coat. All joints shall be watertight. Frames shall be securely anchored in place and be plumb and square; the doors shall fit and operate perfectly.

(b) Finished hardware shall be as follows: Locks and lock trims shall conform to Federal Specification FF-H-106a for "Hardware, Builders: Locks And Door-Trims," Type 86B with trim No. 3 or 5 or lock type 161. Butts shall conform to "Builders' Template Hardware," Commercial Standard CS 9-33, half surface butt hings, size 4-1/2 inch, bronze, 1-1/2 pair. All locks shall be keyed alike. Three keys shall be provided. Before acceptance, the locks shall be tested and knobs tightened and necessary adjustments made so as to leave the entire installation in good working order. The right hand door shall be the active door and shall be provided with an astragel and the lock. The left hand door shall be inactive and shall be provided with the strike, and top and bottom bolts.

7-17. THRESHOLD.- The thresholds for the steel doors shall be of Foralum or abrasive iron of the recessed type and shall be of the width necessary for the steel door. The thresholds shall be securely anchored to the concrete.

7-18. VALVE HOUSE WINDOWS.- (a) Windows shall be standard steel industrial windows of the commercial projected type of the size and arrangement shown on the drawings. Frame, vent and muntin sections shall be solid steel angle bars having a minimum thickness of 1/8" and a depth of 1-3/8". Frame and ventilator corners and joints shall be mortised, tenoned and riveted. Corners of frames and ventilators shall also be welded. Ventilators shall have continuous double contact weathering members of not less than 16 gage steel. Sash shall be bonderized and given the manufacturers' standard prime coat of paint. Windows shall be arranged for inside putty glazing. Hardware shall consist of a cam-type locking handle at sill, and pull at head.

(b) Erection.- The windows shall be erected true and plumb and be anchored and grouted in place as shown on the drawings. The frame shall be caulked from the outside with a nonstaining elastic caulking compound. Erection of windows shall be done by competent steel window erectors and all windows shall be tried and adjusted before glazing.

(c) Glass and Glazing.- (1) Glass shall conform to Federal Specification DD-G-451a for "Glass Flat And Corrugated, For Glazing, Mirrors, And Other Uses." Glass shall be clear, B quality at least 3/16 inch thick.

(2) Glass in windows shall be held in place with approved glazing clips. Windows shall be glazed from the inside using approved metal sash putty. Putty shall be cut flush and neatly painted.

7-19. CALKING.- Door frames shall be calked with a calking compound. The calking compound shall be a non-hardening, waterproof calking material meeting the requirements of Federal Specification TT-C-598 for "Compound, Calking; Plastic (For Masonry And Other Structures)," and shall be Grade 1, color shall be approved by the Contracting Officer. Joints shall be given a coat of shellac or lacquer before calking material is applied. All joints shall be well filled.

7-20. CRANE.- (a) General.- The Contractor shall furnish and install in the valve house as indicated on the drawings a traveling crane and hoist of the following capacity:

	Type of Installation	Capacity in Tons
Traveling Crane	Crane and Hoist	5

The crane and hoist are intended for light use and infrequent duty. Materials and workmanship shall be of the best grade, suitable for the purpose intended. The design stress for any member shall be not greater than one-fifth of the ultimate strength of the material used. Adequate provision shall be made for the lubrication of all moving parts. The crane and hoist shall comply with clearance and reach dimensions shown on the drawings.

(b) Shop Drawings.- The Contractor shall submit drawings of the crane he proposes to furnish in accordance with the provisions of SC-06. The drawings shall be of sufficient detail to enable a check to be made on the design. These drawings shall include a complete and itemized list of all parts to be furnished, with the grade and class of material. Thickness of plates and sizes of structural shapes must be shown either on the part or in the itemized list of parts. Proposed construction shall be clearly shown on the drawings by the liberal use of sections, enlarged details, or by other means. Any item or part omitted from the drawings or list of parts, but needed to comply with the requirements of these specifications or in order to provide complete and workable installations in accordance with the intent of these specifications, shall be supplied by the Contractor the same as if included on the drawings or in the specifications.

(c) Traveling Crane.- The bridge of the traveling crane shall be hand geared, of the single girder type, constructed of fabricated structual steel. The crane shall have a minimum lift of 25' and be similar and equal to Conco No. H2545 top running hand geared crane. The hoist shall be a low head room trolley hoist, spur geared with hand geared trolley, similar and equal to Conco Catalog No. 1354. The crane rails shall be 30 pound ASCE rails.

(d) Chain and Attachments.- Chain and attachments shall meet the applicable requirements of Federal Specifications RR-C-271a for "Chains And Attachments; Welded, Weldless, And Roller Chain," Type I, unless otherwise approved, and shall be galvanized.

(e) Installation.- Crane rails shall be carefully leveled along their length, cross leveled and brought parallel with each other. Rail clips shall then be securely tightened. The crane and hoist shall be carefully assembled in place without forcing or springing. Heavy drifting to aline bolt holes will not be permitted. Trolley shall be assembled to bridge on trolly beams and the equalizing pin adjusted to suit the width of beam if necessary. Lubrication shall be checked and added where necessary.

(f) Acceptance Tests.- Crane and hoist will be tested by the Government as soon as practicable after installation. The tests will include complete operation of the crane and hoist throughout all their functions and may include load tests with 125 percent of normal load. Acceptance will not be made until such tests are completed to the satisfaction of the Contracting Officer.

7-21. PAYMENT.- (a) Miscellaneous Metal Items, Doors and Windows.- Payment for furnishing and installing all structural steel, gratings, window, doors and miscellaneous metal items specified herein, except pipe handrailing and the overhead crane installation, will be made at the contract lump sum price for "Miscellaneous Metal Items" which price and payment shall constitute full compensation for furnishing all plant, labor, material and equipment required for installation of the miscellaneous metal items, windows including glazing, and doors including hardware, as specified herein and/or shown on the drawings.

(b) Pipe Handrailing.- Pipe handrailing will be measured for payment purposes, on the basis of the distance between centerline of end posts or to face of connecting wall as applicable. Payment for furnishing and installing all pipe handrailing, measured as stated above, will be made at the contract price per linear foot for "Handrail, 3 Feet High" which price and payment shall constitute full compensation for furnishing all materials and appurtenances, complete fabrication of the handrails, and the complete installation at the locations shown on the drawings.

(c) Crane.- Payment for furnishing and installing the overhead crane will be made at the contract lump sum price for "Crane, Overhead," which price and payment shall constitue full compensation for all costs of plant, labor, and materials for furnishing and installing the crane unit complete with crane rails and accessories.

SECTION 8 -- ELECTRICAL WORK AND EQUIPMENT

8-01. SCOPE.- (a) The work covered by this section consists of furnishing all plant, labor, equipment, (except the electric motors and accessories specified in Section 9) supplies, and materials, and performing all operations necessary to complete the electrical system for the dam, in strict accordance with this section of the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

(b) The following items set forth the principal items of electrical work to be included under this contract for the dam.

(1) Service entrance from terminal pole to pullbox in dam walkway, with provisions for metering and control of walkway and dam lighting on terminal pole.

(2) Complete conduit and wiring system for lighting the valve house, dam, and walkway across top of dam, including panelboard, receptacles, fixtures, switches, and connections.

(3) Complete conduit and wiring system for gallery lighting and receptacle layout, including fixtures, receptacles, switches, and connections.

(4) Complete conduit and wiring system for gallery ventilators, including control switches and connections.

(5) Complete grounding system with connections to motors, panelboard, conduit system, power company metering equipment, and all other equipment required to be grounded.

8-02. GENERAL.- The installations shall comply with the applicable rules of the National Electrical Code except where otherwise noted on the drawings or specified herein. All electrical materials shall be new and shall conform to the applicable standards of the Underwriters' Laboratories, Inc., except as otherwise specified herein. Defective equipment or equipment damaged in the course of installation or test shall be replaced or repaired in a manner meeting with the approval of the Contracting Officer. The contract drawings indicate the extent and general arrangement of the equipment, conduit, and wiring systems. The Contractor, may, however, subject to the approval of the Contracting Officer, modify the layout indicated on the drawings or specified herein, to more readily conform to the space available and to the equipment he proposes to utilize. If any departures from the contract drawings are deemed necessary by the Contractor, details of such departures and the reasons therefor shall be submitted as soon as practicable, and within 30 days after award of the contract, to the Contracting Officer for approval. No such departures shall be made without the prior written approval of the Contracting Officer.

(a) Standard Products.- Unless otherwise indicated in writing by the Contracting Officer, the materials to be furnished under this specification shall be the standard products of manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design.

(b) Materials and Equipment Schedules.- As soon as practicable and within 30 days after the date of award of contract and before any material or equipment is purchased, the Contractor shall submit to the Contracting Officer for approval a complete list, in triplicate, of materials, fixtures, and equipment to be incorporated in the work. The list shall include the manufacturer, catalog numbers, and such other descriptive data as may be required by the Contracting Officer. No consideration will be given to the partial lists submitted from time to time. Approval of materials will be based on manufacturers' published ratings. Any materials, fixtures, and equipment listed which are not in accordance with the specification requirements may be rejected.

8-03. SPECIAL REQUIREMENTS.- (a) The electrical equipment will be installed in an unheated structure and will be subject to an exceptional amount of moisture. The equipment will stand idle for long periods. All equipment shall be so constructed so that it will not be injuriously affected by the above conditions.

(b) Equipment for the same, similar or allied service shall be of the same manufacture and type, and when of the same rating shall be interchangeable.

8-04. STANDARD RULES, REGULATIONS AND SPECIFICATIONS.- Unless otherwise specified herein or indicated on the drawings, all electrical materials, workmanship, and tests shall be in conformity with the latest published standard rules, regulations, and specifications of the following authorities.

(a) National Electrical Code (NEC).

(b) National Electrical Safety Code (NESC).

(c) National Electrical Manufacturers' Association (NEMA).

(d) American Institute of Electrical Engineers (AIEE).

(e) American Society for Testing Materials. (ASTM).

(f) Insulated Power Cable Engineers Association (IPCEA).

(g) American Standards Association (ASA).

(h) Applicable Federal Specifications.

In case of conflict, the Contracting Officer will decide which authority is applicable, and his decision shall be final.

8-05. CONDUIT AND CONDUIT FITTINGS.- (a) Rigid Metal Conduit.- Rigid metal conduit shall be zinc-coated on the inside and outside and shall conform to the requirements of Federal Specification WW-C-581c for "Conduit, Steel, Rigid, Zinc-coated." In addition to the zinc coating, the inside and outside of the metal conduit shall be coated with either enamel or lacquer. Conduit shall be of the size indicated on the drawings or as required by the National Electrical Code, except that 3/4-inch shall be the minimum size permitted.

(b) Flexible Metal Conduit.- Flexible metal conduit shall be of the concave single-strip type consisting of steel strips helically wound with tight seams and finished so as to provide a smooth even surface within the conduit. It shall be sherardized or shall have other approved surfacing and shall be Neoprene-jacketed.

(c) Conduit Fittings.- Conduit fittings and covers shall be sherardized high-test gray iron or malleable iron castings of the types and sizes required, specified or indicated on the drawings. They shall meet the requirements of the National Board of Fire Underwriters. Approved solid type neoprene gaskets shall be provided between fittings and covers. For conduit sizes 1-1/4 inch and larger, form 8 fittings shall be used. All covers shall be held in place by round-head silicon-bronze machine screws.

(d) Pull, Junction and Outlet Boxes.- All pull, junction and outlet boxes shall be of watertight construction. Approved neoprene gaskets shall be provided between covers and boxes. All covers shall be held in place by round-head silicon-bronze machine screws.

8-06. INSULATED WIRE AND CABLE.- (a) General.- (1) All wire and cable shall be single conductor cables, insulated with moisture and heat-resistant rubber or rubber-like insulating compound and with synthetic rubber jackets or sheaths conforming to the requirements specified below.

(2) The conductor size shall be as indicated on the drawings, or as specified under the detailed requirements for the particular item.

(b) Materials, Construction, and Tests, unless otherwise specified, shall conform to the applicable requirements of the National Electrical Manufacturers Association Publication No. 49-141, February 1949, entitled "Standards for Rubber-Insulated Power and Control Cables." Parts, sections, appendices, grades and classes specified hereinafter will refer to the above NEMA standard, unless otherwise stated.

(c) Conductors shall be of annealed copper wire conforming to the requirements of Part II, Section 3, and shall be tinned or lead alloy coated. Conductors of No. 10 A.W.G. and smaller shall be solid and conductors of No. 8 A.W.G. and larger shall have class B stranding.

(d) Insulation.- (1) Material- Conductor insulation compound shall be suitable for conductor temperature of not less than 75° C; shall be moisture resisting; and, for conductors specified to be insulated for Rated Circuit Voltage of 600 volts and less, shall be either a vulcanized oil-base rubber,

rubber-like "Ozone-Resistant" grade of insulation, or a vulcanized rubber, rubber-like or synthetic rubber "Heat-Resisting" grade of insulation. The "Ozone-Resistant" grade of insulating compound shall conform to Part II, Section 4, "Ozone-Resistant, Grade O", and, in addition, shall have specific inductive capacity characteristics as follows:

> The compound, after a 24-hour immersion in distilled water at room temperature (but not less than 21°C), shall show a specific inductive capacity not greater than 4.5; and, after a continuous 14-day immersion, shall show a specific inductive capacity not more than 7 percent higher than the value determined at the end of the initial 24-hour period, nor more than 3 percent higher than at the end of the seventh day.

The "Heat-Resisting" grade of insulating compound shall conform to Part II, Section 4, "Heat-Resisting, Grade H", and, in addition, shall have specific inductive capacity and mechanical water absorption characteristics as follows:

> The compound, after a 24-hour immersion in distilled water at room temperature (but not less than 21° C.), shall show a specific inductive capacity not greater than 5; and, after a continuous 14-day immersion, shall show a specific inductive capacity not more than 10 percent higher than the value determined at the end of the initial 24-hour period, nor more than 3 percent higher than at the end of the seventh day.
>
> The compound, after a 7-day's immersion in distilled water at 70±1° C., shall not absorb more than .015 grams of water per square inch of surface exposed to the water.

The manufacturer shall perform tests on samples of the insulation taken from the finished product to determine compliance with the specified physical, heat-resistant, ozone-resistant and moisture-resistant requirements. Test procedure shall be in accordance with the applicable requirements of either ASTM Standard D470-54T, entitled "Methods of Testing Rubber and Thermoplastic Insulated Wire and Cable (Tentative)" or the Standards of the Underwriters' Laboratories, Inc., for Rubber-Covered Wire and Cables.

(2) Insulation Thickness.- Thickness of conductor insulation for the circuits listed below shall not be less than that shown in Table IV of Part II, Section 4, for the Rated Circuit Voltage as specified below:

Circuit	Rated Circuit Voltages (Volts)
Power Circuits and Lighting Circuits, each operating at 600 volts or below	0-600

(e) Jackets.- Over the insulated conductor there shall be applied an outer jacket of an oil-resisting thermosetting synthetic compound conforming to Part II, Section 7, paragraph RU18-35, Type 3, with physical properties conforming to paragraph RU18-83 of Part IV, Section 15. The jacket shall be in direct contact and adhere to the conductor insulation. The jacket thickness shall be as specified in Part II, Section 7, paragraph RU18-38, Table X.

(f) Dimensional Tolerance.- The outside diameter of single-conductor wires and cables shall not vary more than 10 percent from the calculated outside diameter based on the thickness, including tolerance, of the component materials specified.

(g) Approval.- Manufacture of the wire or cable shall not be started until all materials to be used in the fabrication of the finished wire or cable have been approved by the Contracting Officer.

(h) Inspection and Tests.- (1) General.- Inspection and tests of wire and cable furnished under these specifications shall be made by and at the plant of the manufacturer. All tests and inspections shall conform to the procedures set forth in the applicable specification or standards referred to herein.

(2) Reports.- Four certified copies of test reports, indicating the results of tests made, shall be furnished the Contracting Officer, and no wire or cable shall be shipped until authorized by the Contracting Officer.

8-07. INSTALLATION OF CONDUIT AND WIRING.- (a) Conduit Installation.- (1) All wiring shall be run in rigid metal conduit, unless otherwise specified, complete with pull, junction and outlet boxes, and fittings to make a steel pipe system that is continuous mechanically and electrically. Conduit sizes shall be as indicated on the drawings and in accordance with the requirements of the "National Electrical Code".

(2) Joints shall be made so that the ends of the conduit butt together in the center of the couplings. No running thread couplings shall be used on runs of standard conduit. Threadless fittings may be used on standard conduit only in special cases and then only upon prior approval of the Contracting Officer. Whenever conduit passes through a construction joint, provision shall be made to protect the conduit against shearing due to differential settlement. Protection of conduit at monolith joint shall be in accordance with detail shown on drawing No. 801.1423.

(3) Conduit bends shall be made with approved bending machines. Any conduits crushed or deformed in any way shall not be installed. In no case shall conduits be bent to radii of less than that of standard factory bends.

(4) Open conduit ends shall be kept plugged or capped, except when working on the run, in order to exclude dirt and moisture. All conduit runs shall be checked to insure that they are free of any obstructions or moisture

before wires are pulled into them. A clogged run of conduit shall be entirely freed of the obstruction or shall be replaced.

(5) Conduit runs shall be pitched to insure suitable drainage. These runs which may trap water shall be provided with drain plugs, similar and equal to Russell & Stoll Company type "DR" drain, so that water may be drained off periodically. Unsealed drainage openings in the conduit run which would permit leakage of gas or water into the run will not be permitted.

(6) Conduit shall be firmly secured at the entrance to all panels and control cabinets, using two locks nuts and a bushing, or the equivalent thereof at each entrance.

(7) The conduit system shall be thoroughly and completely grounded. All conduits entering the load center distribution panelboard shall be furnished with grounding bushings.

(8) Exposed runs of conduit shall be rigidly and securely fastened to the dam structure on not greater than 5-foot centers. Hangers, supports or fastenings shall be provided at each elbow and at the end of every straight run terminating at a box or cabinet. The conduit shall be installed with runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings, with right-angle turns consisting of cast-metal fittings or symmetrical bends. Bends and offsets shall be avoided where possible.

(9) Conduit shall be supported on approved types of galvanized wall brackets, ceiling trapeze, strap hangers, or pipe straps, secured by means of expansion bolts in concrete and machine screws on metal surfaces. Wood plug inserts or nails will not be permitted as a means of support. The required strength of supporting equipment and the size and type of anchors shall be based on the combined weights of the consuit, conductors and hangers.

(10) At joints and terminals the ends of conduit shall be cut square with hand or power saw or approved pipe cutter. Cut ends shall be reamed to remove burrs and sharp edges. Threads cut on conduit in the field shall have the same effective length and the same thread dimensions and taper as required for factory-cut conduit threads.

(b) Rubber-Insulated Cable Installation.- Splices for 120 and/or 240-volt circuits shall be made in conformity with the requirements of the "National Electrical Code." Conductors shall be continuous from outlet to outlet. Wire connectors of insulating material or solderless pressure connectors, properly taped, shall be utilized for all splices where possible. Soldered joints insulated with tape shall be kept to a minimum. Home runs may be combined in one conduit, provided all connections are in accordance with the National Electrical Code requirements and the maximum unbalanced current in the neutral does not exceed the capacity of the conductor.

(c) Conduit System.- Rigid metal conduit shall be furnished and installed complete and ready for installation of all apparatus, equipment, fixtures and wiring; as required for the proper operation of the entire electrical system, and as indicated on the drawings. Conduits for the ventilator motor circuits shall terminate as a receptacle in close proximity to each motor.

(d) Lighting and Power Circuits.- The lighting and power feeder shall be a 3-wire, 120/240-volt service. The branch circuits shall be 120-volt, 2-wire, or 3-wire, 240 volt single phase as indicated or required. The size of wire and cable shall be as indicated on the drawings or of larger sizes if so required by the National Electrical Code. Minimum wire size shall be No. 12 A.W.G. All conductors of a circuit shall be installed in the same raceway.

(e) Service Entrance.- Service entrance for 120/240 volt, single phase, 3-wire service shall consist of terminal pole, a suitable heavy-duty galvanized secondary rack attached to terminal pole with 2-5/8" galvanized machine bolts and 2 lock washers, weatherhead, rigid metal conduit, weatherproof fittings, wiring, meter socket, service disconnect, walkway and dam lighting circuit breaker switches, and underground conduits to pullbox in dam. Meter socket and service disconnect shall be grounded by means of a ground rod installation. The installation shall conform to the rules of the power company for service entrances and metering.

8-08. GROUNDING.- (a) General.- A permanent and effective grounding system shall be provided for the dam for grounding the conduit systems, metering equipment, neutral conductor of the wiring system, and all other equipment required to be grounded in conformity with the rules of the National Electrical Code or with special regulations of state or local inspection authorities. The ground connection of the electric-system neutral and conduit system shall be made at the service disconnect and distribution panelboard. All ground wire shall be T.B.W.P. soft-drawn copper of No.1/0 gage.

(b) Ground Rods.- There shall be installed at the dam, as indicated on the drawings, two ground rods installations consisting of copper-clad steel rods not less than 3/4-inch in diameter, 10 feet long, driven full length into the earth. The maximum resistance of the grounding system shall not exceed 10 ohms. If this resistance cannot be obtained with a single rod, a sufficient number of additional rods shall be installed not closer than 6 feet on centers so that the resultant resistance will be within that limit. The tops of the rods shall be six-inches, and the ground wires attachment 12 inches below the grade line.

8-09. MISCELLANEOUS MATERIALS.- (a) Rubber Insulating Tape.- Rubber insulating tape shall conform to Federal Specification HH-T-111C for "Tape, Rubber (Natural and Synethic), Insulating."

(b) Friction Tape.- Friction tape shall conform to Federal Specification HH-T-101a for "Tape, Friction."

(c) Rubber Cement.- Rubber cement shall conform to Military Specification MIL-C-897a for "Cement; Rubber (Synthetic - Rubber - to- Synthetic - Rubber - Adhesion)."

(d) Insulating Varnish.- Insulating varnish shall conform to Military Specification MIL-V-1137A for "Varnish, Electrical-Insulating (For Electro-Motive Equipment)", grade as directed or specified for the respective work.

8-10. OUTLETS.- Outlets shall be installed in the locations shown on the drawings. The Contractor shall study the general structure plans in relation to the spaces surrounding each outlet in order that his work may fit the other work required by these specifications. When necessary, the Contractor shall relocate outlets so that, when fixtures or other fittings are installed, they will be symmetrically located according to structure layout and will not interfere with other work or equipment. All outlet covers shall be held in place by round-head, silicon-bronze machine screws.

8-11. LIGHTING FIXTURES.- (a) General.- Lighting fixtures and lamps shall be furnished and installed in the quantities and locations indicated on the drawings.

(b) Type A.- Single light, asymmetric lens, flush-mounted, cast-iron deep type, housing, cast-aluminum cover walkway light fixture, complete with 25-watt lamp, similar and equal to Crouse-Hinds Company Catalogue No. 42912 fixture except with FD series condulet. Cover shall be furnished with neoprene gasket for watertight joint with housing.

(c) Type B.- Single light, vapor-tight, porcelain-enameled, 16-inch diameter dome reflector, complete with 200-watt lamp, similar and equal to Crouse-Hinds Company VH series fixtures. Fixtures shall be installed in such a manner as to avoid conflict with crane.

(d) Type C.- Single light, vapor-tight ceiling fixture with globe and equipped with 200-watt lamp as indicated on the drawings, similar and equal to Crouse-Hinds Company VH series fixtures.

(e) Type D.- Single light, dust-tight and weather resistant, bracket type complete with 200-watt lamp and globe, as indicated on the drawings, similar and equal to Crouse-Hinds Company Catalogue No. DLB 21F exterior lighting fixture.

(f) Type E.- Single light, vapor-tight, with globe and screw guard, and equipped with 60-watt or 100-watt lamp, as indicated on the drawings, similar and equal to Crouse-Hinds Company V series fixture.

(g) Type F.- Floodlight, with 180° horizontal beam spread and narrow vertical beam spread fresnel lens and spherical reflector, cast aluminum housing with integral slip fitter for 1-1/2-inch pipe, tamper-proof set screws for leveling, and equipped with 300-watt, PS-30 bulb, medium screw base, clear lamp, similar and equal to Crouse-Hinds Company Catalogue No. 44602 type PLB floodlight.

(h) Type G.- Floodlight with 131 degree horizontal beam spread and 47 degree vertical beam spread with polished alzak reflector and clear horizontal spread, heat resistant lens. The housing shall be cast aluminum with means for vertical adjustment of the direction of beam. The floodlight shall be equipped with a 500-watt, PS40 lamp and shall be similar and equal to Crouse-Hinds Co. Type MDB-14 floodlight. A suitable mounting bracket shall be furnished for mounting the floodlight on top of the 8-inch diameter metal terminal pole.

8-12. RECEPTACLES AND SWITCHES.- (a) Receptacles shall be 30-ampere, 250-volt, 2-pole, 2-wire polarized for 120-volt, single phase circuits and 30-ampere, 250-volt, 3-pole, 2-wire polarized with third-pole grounded for 240-volt, single phase circuits. The receptacles shall be of watertight construction and shall be similar and equal to Crouse-Hinds Company Type FC-S1 series condulet with Type BRD receptacle housing No. BRD8302-S1 and No. BRD8303-S1, respectively, as indicated on the drawings. Three type BP, 30-ampere, 2-pole plugs with clamping nut for 120-volt receptacles and two Type EP, 30 ampere, 3-pole plugs with clamping nut for 240-volt receptacles shall be furnished. The rerereceptacles shall conform to the requirements of Federal Specification W-R-151a, Type II, Style number S.

(b) Switches shall conform to the requirements of Federal Specifications W-S-896 or W-S-893 and shall carry the "T" rating of the Underwriters' Laboratories, Inc. All switches shall be enclosed in boxes with threaded hubs and vapor-tight covers, similar and equal to Crouse-Hinds Company Type FS series condulets and DS181 cover as indicated on the drawings. All switches shall be tumbler-type rated 10 amperes, 125-volt, heavy duty, similar and equal to type indicated on the drawings.

8-13. SERVICE EQUIPMENT.- Main disconnecting means (service disconnect) shall be of the thermal overload circuit breaker type equipped with an external lever or handle for manual operation. The unit shall be enclosed in a weatherproof cast iron NEMA type III enclosure with corrosion resistant baked enamel finish and shall be equipped with means for padlocking in both "on" and "off" positions. The enclosure shall have a 2-inch threaded top and 2-inch and 3/4 inch bottom outlets and a 1/2-inch threaded side outlet as indicated on the drawings. Circuit breaker shall be 100-ampere, "E" frame with 70-ampere trip rating, 240-volt A-C, 3-wire, 3-pole, solid neutral conforming with the applicable requirements of Federal Specification W-P-131a, Class C. The service entrance installation shall conform to the requirements of the power company. An approved type of galvanized steel bracket shall be utilized to rigidly support the service disconnect to the terminal pole. Padlock shall conform to the requirements of paragraph 8-16.

8-14. PANELBOARD.- A load center distribution panelboard to be used for lighting, receptacle and ventilator motor duty shall be furnished and installed in the Valve House in accordance with the details shown on the drawings. The panelboard shall be of the dead-front, circuit breaker, safety type, designed for operation on a 120/240-volt, single-phase, 3-wire, grounded-solid-neutral system. The panelboard shall be provided with a 100-ampere, "E" frame with 70-ampere trip rating, main breaker and the number and size of single and double pole branches as indicated or required. The panelboard enclosure shall be constructed of zinc-coated sheet steel and shall conform to the requirements of Underwriters Laboratories, Inc. standard for cabinets and cutout boxes. Boxes shall be zinc-coated after fabrication. Trims shall have a baked-on primer coat and baked enamel finish. The trim shall be fitted with hinged doors having combination lock and latch. A directory holder with glass plate and metal frame shall be mounted on the inside of the door. A neatly typed directory, properly identifying each circuit, shall be mounted under the glass. The panelboard shall be installed with the top 6ft.-6in. above floor and shall be rigidly secured in place. The panelboard shall conform to the requirements of Federal Specification W-P-131a, for "Panelboards; Equipped with Automatic Circuit Breakers" Class C.

8-15. WALKWAY AND DAM LIGHTING CONTROL.- Control and protection of walkway and dam lighting circuits shall be by means of single-pole, 15-ampere circuit breakers enclosed in weatherproof, cast iron, NEMA Type III enclosures with corrosion resistant finish and equipped with means for padlocking in both "on" and "off" positions. Circuit breakers shall be trip free when padlocked in "on" position and shall conform to Federal Specification W-P-131a, Class C. Padlocks shall conform to the requirements of paragraph 8-16. Approved type galvanized steel brackets shall be utilized to rigidly support the circuit breakers to the terminal pole.

8-16. PADLOCKS.- Padlocks shall conform to the requirements of Federal Specification FF-P-101b for "Padlocks" Type EPB. Each padlock shall be furnished with chain and chain shall be firmly secured to equipment being padlocked. All padlocks shall be opened by the same key and four such keys shall be furnished.

8-17. VENTILATOR MOTOR CONTROL.- (a) Controller.- Each motor shall be provided with a suitable controller and devices which will perform the functions as specified for the respective motors. All controllers shall conform to the adopted standards and recommended practices of the National Electrical Manufacturers Association, Standard for Industrial Control Equipment. Manual controllers for motors larger than 1/4 horsepower shall be specifically designed for the purpose and have a horsepower rating adequate for the motor.

(b) Motor-Disconnect Means.- Each motor shall be provided with a disconnecting means when required by the National Electrical Code even though not indicated on the drawings. A circuit-breaker or horsepower-rated switch in a panelboard will be acceptable as a disconnect means, if located in the same room or within sight of the motor controller. A quick-make and quick-break general-use tumbler or snap switch will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least double the rating of the controlled equipment. Switches of 30-to-400 ampere capacity shall be of the enclosed, quick-make and quick-break type, horsepower-rated. Switches shall disconnect all ungrounded conductors.

8-18. EQUIPMENT CONNECTIONS.- Controllers or motors, disconnect switches, and all control, protective, and signal devices for motor circuits, except where such apparatus is furnished mounted and connected integral with the motor-driven equipment, shall be installed, connected, and left in operating condition. Connections to motors shall be made by means of flexible 3 conductor, Code Type SO Cable. Crouse-Hinds Co. Type CGB connector or equal shall be utilized at cable entrance to motor terminal box. The size of conductors between motors and control or protective apparatus shall be as recommended by the manufacturer of the apparatus, or as required by the National Electrical Code.

8-19. TERMINAL POLE.- (a) Pole.- The pole shall be of commercial wrought steel pipe, standard strength, continuous length and of size indicated on the drawings. The pole shall be closed or capped at both ends.

(b) Installation.- The pole shall be embedded not less than 12 inches in the concrete wing wall and the earth fill around that portion of the pole above wing wall shall be well tamped to insure that the earth is tightly packed. Additional earth shall be placed around the pole in a conical shape and packed tightly in order that the water will drain away from the pole.

(c) Finish.- The pole shall be painted in accordance with the requirements of Section 12. In addition that portion embedded in the earth fill shall be painted with a heavy coat of asphaltum.

8-20. REPAIR OF EXISTING WORK.- The work shall be carefully laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, ceilings, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, this work shall be carefully done, and any damage to structure, piping, or other equipment shall be repaired by skilled mechanics of the trades involved, at no additional cost to the Government.

8-21. TESTS.- (a) General.- Field tests shall be made on the complete electrical system, including all electrical equipment, and all tests shall be witnessed by the Contracting Officer, or his authorized representative. The Contractor shall correct, to the satisfaction of the Contracting Officer, and without expense to the Government, all defects found during the tests.

(b) Field Tests.- (1) Insulation Resistance.- After all equipment connections are made, all wiring shall be tested for insulation resistance. Insulation to ground of the complete system shall be not less than one megohm for the 120/240-volt circuits.

(2) Ground Resistance.- The grounds shall be tested for resistance and if found to be above ten ohms they shall be treated with copper sulphate, or additional grounds installed to reduce the resistance to ten ohms.

(3) Operating Test.- After completion of all electrical work under this contract, the entire electrical system shall be thoroughly tested by operation of the connected equipment. The equipment shall be operated by the Contractor under as nearly normal operating conditions as practicable. All tests shall be made at the direction and to the satisfaction of the Contracting Officer before final acceptance is made. The Contractor shall furnish all instruments, necessary electric power and personnel required for the tests.

8-22. PAYMENT.- Payment for furnishing and installing the complete electrical system for the dam (except the motors and accessories specified in Section 9), will be made at the contract lump sum price for "Electrical Work and Equipment" which price and payment shall constitute full compensation for all costs of plant, labor and material required for installing the electrical system complete with all equipment and other accessories, in strict accordance with this section of the specifications, including the prescribed tests.

SECTION 9 -- ELECTRIC MOTORS

9-01. SCOPE.- This section covers the requirements for the motors to be furnished to drive the fans for the ventilating system specified under Section 10. Motors shall be designed to operate on a single Phase, 120-volt, 60-cycle current.

9-02. STANDARD RULES AND SPECIFICATIONS.- Unless otherwise specified all material and workmanship shall conform to the latest applicable standards, regulations and specifications of the American Institute of Electrical Engineers, the National Electrical Manufacturers Association, the Underwriters' Laboratories Inc., and the American Standards Association. Tests shall be made in conformity with the applicable standards of the American Institute of Electrical Engineers.

9-03. CORROSION PREVENTION AND FINISH PAINTING.- (a) General.- The motors furnished under these specifications will be subjected to severe moisture conditions and shall be designed to prevent deterioration from such exposure. The general requirements to be followed to mitigate corrosion are specified below. Any additional special treatment or requirement considered necessary for any individual items is specified under the respective item.

(b) Fastenings and Fittings.- All screws, bolts, nuts, pins, studs, springs, washers, and other similar fittings shall be of corrosion-resisting material or shall be treated in an approved manner to render them resistant to corrosion.

(c) Corrosion-resisting Materials.- Corrosion-resisting steel, copper, brass, bronze, copper-nickel and nickel-copper alloys are acceptable corrosion-resisting materials. However, contact between dissimilar metals should be avoided as much as practicable, except where one of the dissimilar metals is steel or in the case of wiring and connections.

(d) Corrosion-resisting Treatments.- Galvanizing, sherardizing, and zinc, cadmium and copper plating, when properly done and of a sufficiently heavy coat, are approved corrosion-resisting treatments. Other corrosion-resisting treatments may be used if approved by the Contracting Officer.

(e) Frames.- Motor frames, if of steel, and if they will be coated with varnish during the process of insulating the winding, shall be cleaned of rust, grease, mill scale, and dirt, and then treated with an approved iron and zinc phosphate solution followed by rinsing with a chromic acid solution, bonderizing or equivalent process. If the motor frame is not coated during the process of insulating the windings then, in addition to the above, they shall be given one coat of a zinc chromate primer conforming to the requirements of Joint Army-Navy Specification Jan-P-735, "Primer, Paint, Zinc-Chromate, Alkyd Type", and then two coats of moistureproof varnish, all cured as required. For items of cast construction, the iron and zinc phosphate treatment may be omitted.

(f) Cores.- The assembled motor core shall be thoroughly cleaned and then immediately primed on all surfaces by applying, except on air gap surfaces, two coats of an approved moisture-resisting and oil-resisting insulating varnish conforming to Military Specification MIL-V-1137A, "Varnish, Electrical-Insulating (For Electro-Motive Equipment)", type BA or CA. Air gap surfaces shall be given one coat.

(g) Shafts.- Exposed surfaces of motor shafts, except for bearing surfaces and except for the omission of the iron and zinc phosphate treatment, shall be treated as specified for frames, paragraph 9-03(e) above, and then given two coats of a moistureproof varnish, each cured as required.

(h) Finish Painting.- Finish painting of all equipment shall be in accordance with the standard practice of the manufacturer, as approved by the Contracting Officer.

9-04. DATA TO BE SUBMITTED FOR APPROVAL.- Complete descriptive specifications of the motor shall be submitted for approval of the Contracting Officer and such approval shall be obtained in writing prior to purchase of the motors.

9-05. TYPE.- The motors to be supplied under these specifications shall be of the normal or low starting torque, low starting current, full-voltage starting, alternating current, induction type, squirrel-cage, single speed conforming to the requirements of Federal Specification CC-M-636a, for "Motors, Fractional-Horsepower, (Alternating-Current)", except as hereinafter specified.

9-06. RATING.- Each motor shall be wound for single-phase 120-Volt, 60 cycle, alternating current. The rated horsepower shall be such as to limit the temperature rise (by therometer), under continuous rated full-load conditions, to those established by A.S.A. Standards for 40° C. rated motors. The motors shall be capable of carrying continuously 1.15 times their rating without damaging the windings.

9-07. OPERATING CHARACTERISTICS.- (a) Running.- The motors shall operate with a minimum of vibration and noise.

(b) Overload Protection.- Each motor 1/8 horsepower or larger, shall be provided with thermal-overload protection. The overload protective device shall be provided either integral with the motor or controller. The Protective device shall be of the manually reset type.

(c) Power Factor and Efficiency.- The power factor and efficiency shall be guaranteed for full load, 3/4 full load, and 1/2 full load. The guaranteed values shall be as high as practicable with the type of construction specified, and shall be included in the data submitted for approval in accordance with paragraph 9-04.

9-08. FRAMES.- (a) The motor shall be classified under "degree of inclosure" as "open-dripproof." However, "enclosed" type can be furnished if it is a standard component part of ventilator being furnished. Size and dimensions of frame shall conform to the standards of the National Electrical Manufacturers' Association. The frames shall be treated to resist corrosion as specified in paragraph 9-03(e) above.

(b) Eyebolts.- Eyebolts, located in an approved manner, shall be provided on all motors weighing 100 pounds or more for handling the motors.

9-09. INSULATED WINDINGS.- (a) General.- Windings for NEMA frame, size 445, and smaller machines may be random wound in partially closed slots. Special Class "A" moisture-proof insulation shall be used.

(b) Special Class "A" Moisture-Proof Insulation.- (1) Insulation shall be of a type designed and constructed to withstand the severe moisture conditions and accompanying wide ambient temperature variations to which the motors will be subjected. The following specifications describe the minimum requirements for acceptable insulation and are not intended to restrict or prohibit the use of materials or methods which will give equal or better performance.

(2) Insulated windings, if of random wound coils, shall be completely assembled in the core before impregnating with the insulating compound. The windings shall be securely held in the core slots by wedges of either laminated phenolic material, impregnated fibre, or maple wood which has been thoroughly impregnated by boiling in an insulating oil. Impregnation of the windings with the insulating compound shall be by the immersion method; which shall be accomplished by first heating the winding assembly for a sufficient period of time to thoroughly dry it out; then before any appreciable drop in the assembly temperature occurs, completely immersing it in the insulating compound for a period of time sufficient to effect thorough penetration of the compound into all interstices; followed by draining and curing by baking at the temperature and period of time specified for curing the insulating compound used. The temperature of the curing oven shall be automatically maintained. The above procedure shall be repeated as often as necessary (but in no case less than twice) to fill-in and seal-over the interstices of the winding.

(3) Magnet wire shall be double synthetic resin enameled and single paper covered, and shall conform to Joint Army-Navy Specification JAN-W-583 for "Wire, Magnet."

(4) Insulating varnish or compound shall be of the solvent type, moisture and oil proof, and after being cured, shall show no cracks from contraction or expansion nor soften due to the operating temperature of the machine or change in ambient temperature, nor show any deterioration due to repeated alternate wetting and drying. The insulating varnish shall conform to Military Specification MIL-V-1137A, "Varnish, Electrical-Insulating (For Electro-Motive Equipment)".

9-10. SHAFTS.- Shafts shall be made of high grade hot-rolled steel of adequate strength and rigidity, finished all over, with the journal surface polished. The diameter at the bearings shall be larger than the diameter of the shaft extension and the diameter under the core laminations, larger than the diameter at the bearings. Shafts shall be treated to resist corrosion as specified in paragraph 9-03(g)

9-11. BEARINGS AND LUBRICATION.- The motors shall be provided with ball bearings and the design of the housing and method of assembly shall permit ready removal of the end brackets and prevent escape of lubricant and entrance of foreign materials. Unless the bearings are of an approved pre-lubricated type requiring no addition or change of lubrication for a period of at least five years, fitted openings located on the top and bottom respectively of the bearing housing and readily accessible shall be provided for applying and draining the lubricant. Pressure lubrication fittings shall not be used. When equipment is to be assembled adjacent to or bolted to the motor end bell, suitable filler and drain pipe extensions, with the ends properly fitted and easily accessible, shall be provided.

9-12. TERMINAL BOXES AND STATOR LEADS.- Stator leads shall extend outside the frame; shall have insulation equivalent to that of the motor windings, and shall be terminated in a two-piece, 4-position, watertight terminal box rigidly bolted or equally secured to the motor frame. They shall be sealed with a compound of litharge and glycerine where they pass through the frame. Two-piece terminal connectors shall be provided on the end of each lead for making external connections, and shall be marked by die stamping, in accordance with Joint Army-Navy Specification JAN-E-251, "Electrical-Equipment; Rotation, Connections, and Terminal Markings For." Conduit entrance to the terminal box shall be threaded.

9-13. TESTS.- (a) General.- Each motor furnished shall be given an approved routine test, prior to shipment.

(b) Routine Tests. Routine tests on each motor shall be as follows:

Excitation Test. (One point-no load, volts, amperes and watts)

Impedance Test. (One point-half voltage amperes and watts)

General Operation.

Insulation Resistance - Temperature Test. (One point)

Resistance Measurements.

Dielectric.

(c) Test Reports.- Test reports, certified and in quintuplicate, recording all data obtained during any given test, shall be furnished the Contracting Officer.

9-14. RENEWAL PARTS AND INSTRUCTIONS.- The electrical manufacturer shall submit a complete list of renewal parts with prices and parts numbers for each different rating of motor. This list, accompanied by complete instructions for the proper installation, inspection, and maintenance of the machines furnished for this particular service, shall be supplied in sextuplicate to the Contracting Officer not later than the date the equipment is shipped from the manufacturer's plant. The above instructions shall include a cross-sectional drawing indicating the major component parts of the motor and the procedure for disassembly.

9-15. PAYMENT.- No separate payment will be made for the work, materials, supplies, or tests covered in this section of the specifications and all costs in connection therewith shall be included in the contract lump sum price for "Ventilating System".

SECTION 10 -- VENTILATING SYSTEM

10-01. SCOPE.- The work covered by this section of the specifications consists in furnishing all plant, labor, equipment, appliances, and materials, and in performing all operations in connection with the installation of mechanical ventilating systems for the galleries of the dam, complete, in strict accordance with this section of the specifications and the applicable drawings.

10-02. GENERAL.- (a) There shall be two mechanical ventilating systems provided, one system for exhausting air from the gallery in monolith IX and one system for exhausting air from the gallery in monoliths XI, XII and XIII. Each ventilation system shall consist of a blower unit located in a recess at the top of the dam and duct extending down into the gallery. The contract drawings indicate the extent and general arrangement of the ventilating systems. If any departures from the contract drawings are deemed necessary by the Contractor, details of such departures and the reasons therefor shall be submitted as soon as practicable to the Contracting Officer for approval. No such departures shall be made without prior written approval of the Contracting Officer. Equipment shall provide adequate and acceptable clearances for entry, servicing, and maintenance.

(b) Standard Products.- The equipment to be furnished under this specification shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer.

(c) Material and Equipment Schedule.- As soon as practicable, and within 30 days after date of award of contract and before commencement of installation of any materials or equipment, a plan showing the proposed ventilating equipment, ductwork, etc., with clearances, together with a complete schedule of materials and equipment proposed for installation shall be submitted for the approval of the Contracting Officer. The schedule shall include catalogs, cuts, diagrams, drawings, and such other descriptive data as may be required by the Contracting Officer. In the event any items of materials or equipment contained in the schedule, or layout arrangement fail to comply with the specification requirements, such items or layout arrangement may be rejected. The data shall be submitted for approval in accordance with the provisions of paragraph SC-06.

10-03. WORKMANSHIP.- Equipment and ductwork shall be installed in accordance with the recommendations of the manufacturer and the best standard practice for this type of work.

10-04. BLOWER.- The blower units shall consist of a centrifugal type fan, driven by a direct connected electric motor, installed on approved vibration-isolation supports, at the locations shown on the drawings. The blower for ventilating the gallery in Monolith No. IX shall be similar and equal to No. 1½ utility set as manufactured by the American Blower Corporation, Detroit, Michigan, be driven by 1/2 h.p. motor and have an air capacity of 770 cfm when operating against 3/8 inch static pressure, at a speed not to exceed 1200 rpm. The blower for ventilating the gallery in monoliths Nos. XI, XII and XIII shall be similar and equal to No. 1-3/4 utility set as manufactured by the American Blower Corporation, Detroit, Michigan, be driven by 3/4 hp motor and have an air capacity of 970 cfm when operating against 1/2" static pressure, at a speed not to exceed 1200 rpm. Fans shall be rated and constructed in accordance with Bulletin No. 110 of the National Association of Fan Manufacturers Inc. The impeller wheels shall be of the multiblade type with curved blades, rigidly constructed, accurately balanced both statically and dynamically, and free from objectionable vibration or noise. The bearings shall be self-alining and self-oiling with adequate oil reservoirs. Each fan outlet shall be of ample proportions and shall be equipped with a heavy bronze grille screen. The inlet shall be equipped with a device for attaching flexible connection between blower and duct. Each motor shall conform to the provisions of Section 9 and shall be designed to suit the characteristics of the electric services stated therein. The blower unit shall have the manufacturer's standard factory prime and finish paint coats.

10-05. DUCT WORK.- Ducts, fittings and accessories shall be similar and equal to "Transite Industrial Vent Pipe," as manufactured by Johns-Manville. Ducts shall have tapered ends, and be joined with standard tapered couplings and fittings. Ducts shall be of the sizes shown on the drawings. Joints shall be cemented and neatly finished. Ducts embedded in concrete shall be held securely in place during the placing of concrete to avoid any displacement. Ducts in exposed locations shall be anchored securely to the concrete with approved galvanized anchors spaced not to exceed 3 feet. Ducts in galleries shall be run at the locations shown as near to the corner of ceiling and wall as practicable, so to permit maximum passage way.

10-06. FLEXIBLE CONNECTIONS.- Flexible connections for preventing transmission of vibration shall be installed between the fan housing and the duct with which they are connected. Material for flexible connections shall be an approved glass or asbestos fabric. The flexible material shall be furnished with all necessary fastenings for securing it to the fan and adjoining ducts.

10-07. ELECTRICAL WORK.- All electrical conduit, wiring system, controls and switches for the ventilating equipment is covered in Section 8.

10-08. OPERATION AND MAINTENANCE INSTRUCTIONS.- Operation and maintenance instructions in printed form, for each item of equipment, shall be posted at locations designated by the Contracting Officer.

10-09. TESTS.- Upon completion, and prior to acceptance of the installation, the Contractor shall subject the ventilating system to such operating tests as may be required by the Contracting Officer to demonstrate satisfactory functional and operating efficiency.

10-10. PAYMENT.- Payment for furnishing and installing the complete ventilating systems for the dam, including the fan motors, but excluding the electrical conduit, wiring system and controls therefor as specified in Section 8, will be made at the contract lump sum price for "Ventilating System," which price and payment shall constitute full compensation for all costs of plant, labor, material, accessories and equipment required for installing the ventilating systems complete, in strict accordance with this section and section 9 of the specifications, including the prescribed tests.

SECTION 11 -- INTERIOR DRAINAGE AND SUBDRAINAGE SYSTEMS

11-01. SCOPE.- (a) The work covered by this section of the specifications consists of furnishing all plant, labor, materials and equipment and performing all operations in connection with the construction of a subdrainage system adjacent to the stilling basin and piping for the interior drainage system, all as shown on the drawings, as specified herein, or directed by the Contracting Officer.

(b) Drilling of drain holes in connection with the drainage systems is specified in Section 5.

11-02. GENERAL DESCRIPTION.- (a) Interior Drainage System.- The interior drainage system consists of steel drain pipes embedded in the dam structure together with all discharge pipe and pipe headers required to dispose of the discharge from the drain holes in the dam foundation and from the inspection wells between monoliths. Drainage piping has been installed in monoliths VIII and X, however, it shall be supplemented by new drainage systems as shown on the drawings. The partially installed piping in monolith IX shall be completed and supplemented by a new drainage system as shown on the drawings. The existing drainage piping in partially completed monoliths XI, XII and XIII shall be abandoned and new drainage systems installed. In monoliths which have not been started by others, the interior drainage system shall be completely installed as shown on the drawings.

(b) Subdrainage System.- The subdrainage system shall consist of the drainage piping and surrounding filter material for draining the fill back of the spillway walls; the riser and collector pipes leading from foundation drain holes outside of and adjacent to the spillway walls; and the discharge pipe therefrom extending through the spillway walls. Pipe shall be galvanized, bituminous-coated, corrugated metal pipe. Pipe shall be perforated where indicated on the drawings; metal end plugs shall be installed on open ends of pipe embedded in fill.

11-03. PIPE FOR INTERIOR DRAINAGE SYSTEM.- All drain, discharge and header pipes for the interior drainage system shall be steel pipe conforming to Federal Specification WW-P-406 for "Pipe; Steel and Ferrous Alloy (For) Ordinary Uses (Iron-Pipe-Size)," Type I, Class A. Fittings shall be malleable iron conforming to Federal Specifications WW-P-521b for "Pipe-Fittings; Malleable Iron (Screwed) 150-Pound," Type I. All pipe shall be black pipe. All pipe and fittings for headers and all other pipe not imbedded in concrete shall be coated on the outside with a bituminous coating similar and equal to that specified in paragraph 11-04(c).

11-04. PIPE FOR SUBDRAINAGE SYSTEM.- (a) General.- Corrugated metal pipe for the subdrainage system shall be bituminous-coated, galvanized corrugated metal pipe conforming to the applicable requirements of Federal Specification QQ-C-806a for "Culverts And Underdrains, Corrugated Iron Or Steel, Zinc-coated," Types I and IV as required, Class 4.

(b) Fittings.- Pipe fittings shall be of the same base metal, coating and construction as specified for the pipe. Coupling bands shall be the standard 7-inch length. Fastenings for coupling bands and other fittings shall conform to the above quoted Federal Specification.

(c) Bituminous-Coating.- (1) General.- The inside and outside of corrugated metal pipe and fittings shall be coated completely with asphalt cement to a minimum thickness of 0.05 inches, measured at the crest of the corrugations. Immediately prior to the application of the asphalt cement coating, the pipe shall be cleaned so as to be free of moisture, dirt, grease, mill scale or loose rust, and shall be dry. The asphalt cement coating shall meet the following requirements.

(2) Tests.- Bituminous materials for coating the pipe shall conform to the following requirements and tests. All tests shall be performed by the Contractor or the manufacturer of the pipe, who shall furnish all materials and test equipment required at no additional cost to the Government.

a. General Requirements.- The bituminous coating shall have the following properties:

Test	Limit	Method
Bitumen soluble in cold carbon disulfide; not less than	99.5%	ASTM D4-52
Loss on heating to 163° C; not more than .	1%	ASTM D6-39T or AASHO T 47-42
Penetration of residue after heating, compared with penetration of same sample before testing for loss on heating; not less than	85%	ASTM D5-52

b. Shock Test.- The ability of coated pipe to withstand handling in cold weather is indicated by successfully passing the shock test. Four test specimens shall be prepared in the form of disks 3/8 inch thick and 1-3/4 inches in diameter. Approximately 4 ounces of the material sample shall be heated over a low flame until it becomes fluid; then poured into a mold or molds. Care must be exercised to melt the sample at the lowest possible temperature. The sample shall be stirred thoroughly until it is homogeneous and free from air bubbles when poured into the molds. The material may be poured in one 1-3/4 inch diameter cylinder of such length that the four test specimens may be cut from it, using a wire cutter. The four specimens shall be cooled in a brine of ice and salt at a temperature of 30 degrees F. for a period of at least one hour. The samples shall then be removed one at a time and quickly placed on the anvil of the test apparatus, shown in Figure 1 attached at the end of this section of the specifications, and centered under the plunger. The hammer shall then be tripped from a clear height of 5-1/8 inches. Not more than 8 seconds shall elapse from the time specimen is removed from the brine until the hammer strikes the plunger. For the material to be acceptable, not more then one of the four test specimens shall show a crack. If it is difficult to determine visually whether a specimen has cracked, the specimen shall be removed from the test apparatus and bent slightly.

c. Flow Test.- The ability of the coating on the pipe to remain in place and not flow or sag at summer temperatures is indicated by successfully meeting the flow test. Two test specimens in the form of cylinders each 3/8 inch in diameter and 3/4 inch in length shall be obtained by pouring the molten bitumen remaining after filling the molds mentioned in subparagraph b. above into amalgamated brass molds. Each specimen shall be placed in a corrugation of the corrugated slide (slide to be on the 45 degree slope so that the lower end of each specimen will rest exactly along the line scribed 6 inches from the bottom edge of the slide). The test apparatus, shown in Figure 2 at the end of this section, shall be placed with the specimen in place in an oven maintained at 150 degrees F., plus or minus 2 degrees. After 4 hours the specimen shall be removed from the oven and cooled to room temperature. The distance from the bottom of the corrugated plate to the lower edge of the test specimens shall be measured. This distance subtracted from 6 inches determines the amount of sag or flow. To be acceptable, the flow shall not exceed 1/4 inch for either of the two specimens.

d. Imperviousness Test.- The imperviousness of the coating shall be determined by placing a 25-percent solution of sulfuric acid, a 25-percent solution of sodium hydroxide, or a saturated salt solution in the valley of a corrugation of the coated pipe for a period of 48 hours during which time no loosening or separation of the coating from the galvanizing shall have taken place.

e. Erosion Test.- The coated pipe shall meet the requirements of an erosion test performed on a representative sample of fully coated pipe, 2 feet in length. Each end of the sample shall be closed with a metal cap having the form of a truncated cone with point outward and with the side sloping at approximately 15 degrees with the axis and of such depth that the cone will be able to receive the entire erosive charge. The erosive charge shall consist of 50 pounds of building brick, conforming to the requirements of the ASTM Standard Specification for "Building Brick (Solid Masonry Units Made From Clay Or Shale)" Designation: C62-50, Grade MW, broken into cubical pieces of 2 to 3 inches in size, and 3 gallons of water. The closed sample containing the erosive charge shall be revolved end over end in such manner that the erosive charge will roll alternately along the inner surfaces of the opposite sides of the pipe (inside top and bottom, as when installed in service). The speed of rotation shall be 3.7±0.1 revolutions per minute and the rotations shall be continued until a total of 1,110 revolutions, constituting one test period, and requiring approximately 5 hours, have been made. During each test period at least 75 percent of the sample shall be immersed in water as it revolves. The water shall be maintained at a temperature of 50 to 55 degrees F. After one test period, the bituminous coated internal surface of the sample shall not show areas of bare metal totaling more than 2 inches in length per corrugation on any 4 of the 8 central corrugations.

f. Tenacity Test.- The tenacity of adherence of the coating shall be indicated by dropping a 2-1/4 inch diameter steel ball, weighing 1.67 pounds, from a height of 7-1/2 feet through a pipe of 3 inch inside diameter on the outside crest of a coated corrugation of a sample coated as specified above. The test shall be conducted with the specimen at a temperature of 30 degrees F. Failure of the coating on the metal indicated by spalling from the metal on the inside of the pipe or the formation on the inside of the pipe of cracks longer than one-half inch from the point of impact shall be considered sufficient cause for rejection.

(3) Test Specimens.- All tests on the bituminous coating shall be made on samples secured from pipe delivered or about to be delivered. A five-ounce sample of the bituminous coating shall be obtained by gathering strippings from the inside top of one or more lengths of pipe. Care shall be exercised in sampling to avoid contamination from sand or soapstone that may have been applied after dipping. Seamless metal "ointment boxes" are suggested as containers.

(4) Equipment for Shock and Flow Tests.- a. The equipment for the shock test is illustrated in Figure 1 attached at the end of this section of the specifications. It consists essentially of a rigid metal anvil or base plate not less than 1/2 inch thick and resting on a solid foundation; a hammer weighing 2000 grams (4.4 pounds) arranged to fall freely in suitable guides against a plunger weighing 1000 grams (2.2 pounds) and sliding freely in a vertical sleeve. The lower end of the plunger is spherical in shape with a radius of 1/2 inch. The hammer is held in its guide by a trip mechanism at a clear distance of 5-1/8 inches above the plunger. The split molds for preparing the specimens may be made of brass, with the surfaces amalgamated to prevent sticking, and held together by slip rings pressed on the slightly tapered outside surfaces.

b. The apparatus for the flow test is illustrated in Figure 2 at the end of this section. It consists essentially of a corrugated brass plate 0.03 inch thick, 8 inches long, and 4 inches wide, with corrugations running the long way of the plate, and a metal support to hold the plate on a 45-degree angle with the horizontal. The corrugations have a crest-to-crest dimension of 5/8 inch and a depth of 3/16 inch. A line is scribed 6 inches from the lower edge. The split molds are similar to those used in the shock test.

11-05. FILTER MATERIAL FOR SUBDRAINAGE SYSTEM.- Filter material for the subdrainage system shall be of clean, hard, tough, durable quality, free from laminated, soft or flaky particles, shale, organic matter or other deleterious material. The sources from which the Contractor proposes to obtain the material shall be selected well in advance of the time when the material will be required in the work and suitable samples submitted to the Contracting Officer for approval prior to delivery of any such materials to the site of the work. All points on individual grading curves obtained from representative samples of filter material shall lie between the boundary limits as defined by smooth curves drawn through the tabulated grading limits plotted on a mechanical analysis diagram. The individual grading curves within these limits shall not exhibit abrupt changes in slope denoting skip grading, scalping of certain sizes or other irregularities which would be deterimental to the proper functioning of the filter.

(a) Gravel for Inner Filter.- The filter adjacent to the perforated pipe and spillway walls shall have the following gradation:

Sieve Designation (U. S. Standard Sq. Mesh)	Percent By Weight Passing
1 inch	100
3/4 inch	85-100
1/2 inch	77-100
3/8 inch	36-93
No. 3	17-77
No. 4	7-60
No. 10	0-20
No. 20	0

(b) Sand for Outer Filter.- The filter between the inner filter and the adjoining earth fill shall have the following gradation:

Sieve Designation (U. S. Standard Sq. Mesh)	Percent By Weight Passing
No. 4	95-100
No. 8	80-90
No. 16	55-75
No. 30	30-60
No. 50	12-30
No. 100	3-10

11-06. SHOP DRAWINGS.- The Contractor shall submit for approval shop drawings as specified in paragraph SC-06, showing details of materials, construction and installation for the entire interior drainage system and the subdrainage system, including all required fittings therefor.

11-07. INSTALLATION OF PIPE.- (a) Subdrainage Systems.- Each pipe will be carefully inspected by the inspector immediately before it is placed and defective pipe will be rejected. Pipe shall be cleaned and placed in such a manner as to avoid unnecessary handling or injury to the pipe or its coating. The riser pipes which connect with drain holes shall be grouted into the rock foundation so as to form a tight seal. Each horizontal section of pipe shall rest upon the pipe bed for its full length with recesses to accommodate the joints or couplings. Pipes shall be held firmly in position and alinement during placement of fill and embedment in concrete. Any pipe which has its grade or joint disturbed after laying shall be taken up and relaid. Any section of pipe already laid which is found to be defective or damaged shall be taken up and relaid or replaced as directed by the Contracting Officer, without additional cost to the Government. Pipe shall be laid with the separate sections joined firmly together and with the outside laps of circumferential joints pointing upstream. During installation, the pipe shall be handled with care so as not to damage the asphalt coating. The coupling bands shall lap an equal portion on each section joined, and the bands shall be drawn up tight to insure a tight joint. Ends of adjacent pipe sections shall be spaced so that the corrugations of the coupling bands mesh with those of the pipe. The distance between ends of pipe shall be the minimum for such meshing. Coupling band fastenings and all abraded spots in bituminous coatings shall be given a coating of asphalt cement similar and equal to that specified in paragraph 11-04(c).

(b) Interior Drainage System.- Pipe shall be cut accurately to measurements established at the construction site and worked into place without springing or forcing. Pipe shall have burrs removed by reaming. Changes in direction shall be made with fittings. Pipe and fittings to be imbedded in concrete and all existing pipe to which connections are to be made shall be thoroughly cleaned of all dirt, grease, oil, grout, old concrete and mortar immediately before embedment. Pipe and fittings to be covered with earth shall be thoroughly cleaned and coated with a bituminous coating as specified in paragraph 11-03. Any abraded spots shall be repaired. All joints shall be made up tight, and the assembly held firmly in position and protected from damage or displacement while the concrete or backfill is being placed. Prior to making connections to the existing drain pipes the existing portions of the interior drainage system shall be thoroughly cleaned out by flushing with water or other approved means. All exposed pipe ends shall be capped or plugged during construction and the Contractor shall take all necessary precaution to prevent any pipe from becoming clogged or obstructed. Any pipe which becomes clogged shall be cleaned out in a manner satisfactory to the Contracting Officer at the Contractor's expense.

(c) Installation of Filter Material.- The perforated pipe for the subdrainage system shall be surrounded by filter material which shall extend up the adjacent spillway walls, as shown on the drawings. The filter material as shown on the drawings comprises the inner filter and shall be of the coarser gradation conforming to the requirements of paragraph 11-05(a). In addition, a 6-inch layer of sand conforming to the requirements of paragraph 11-05(b) shall be placed between the inner filter and the adjoining earth fill.

11-08. MEASUREMENT AND PAYMENT.- (a) Pipe for Interior Drainage System.- (1) Measurement.- Steel pipe of each size for the interior drainage system will be measured for payment by the linear foot, and lines will be measured from end to end of each size of the pipe or to centerline of joining pipes without making deductions for fittings or connections.

(2) Payment.- Payment for all pipe, installed as required for the interior drainage system and measured as specified above, will be made at the applicable contract price per linear foot for "Drain Pipe, 3-inch Steel," "Drain Pipe, 3-1/2-inch Steel," "Drain Pipe, 8-inch Steel" and "Drain Pipe, 12-inch Steel." These prices and payments shall constitute full compensation for all costs of all plant, labor, equipment and materials required for furnishing and installing the pipe and fittings, cleaning out and making connections to existing drain pipes, and all incidental operations required to satisfactorily complete the interior drainage system.

(b) Subdrainage System.- Payment for the subdrainage system adjacent to the spillway walls as specified in this section for draining the fill area back of the spillway walls and for conducting discharge from the foundation drain holes adjacent thereto will be made at the contract lump sum price for "Subdrainage System," which price and payment shall constitute full compensation for all costs of plant, labor, equipment and material and performing all operations required for furnishing and installing the corrugated metal pipe, and fittings, furnishing and placing filter material, and all incidental operations required to satisfactorily complete the subdrainage system.

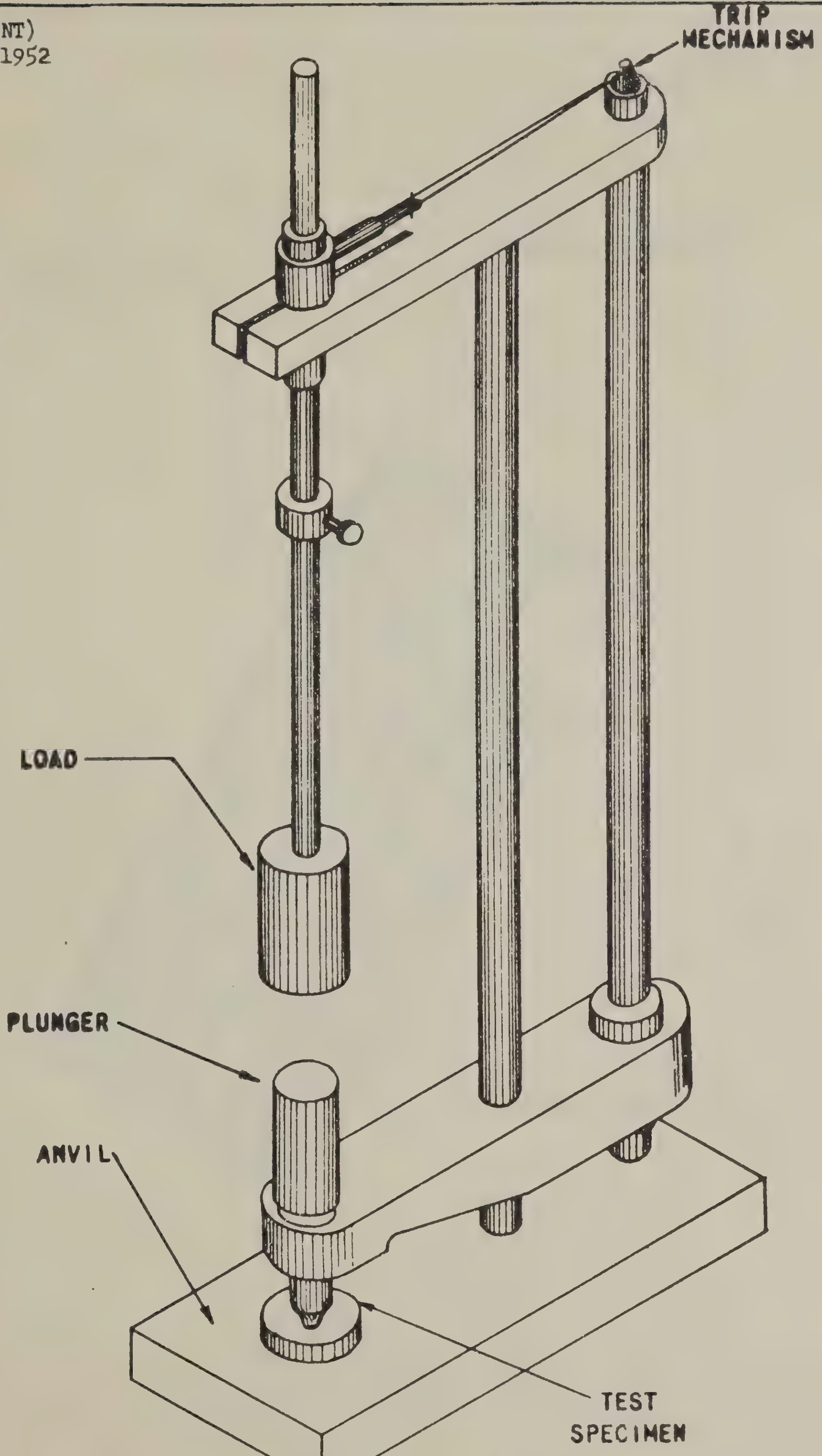

Fig. I SHOCK TEST APPARATUS

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18 March 1952

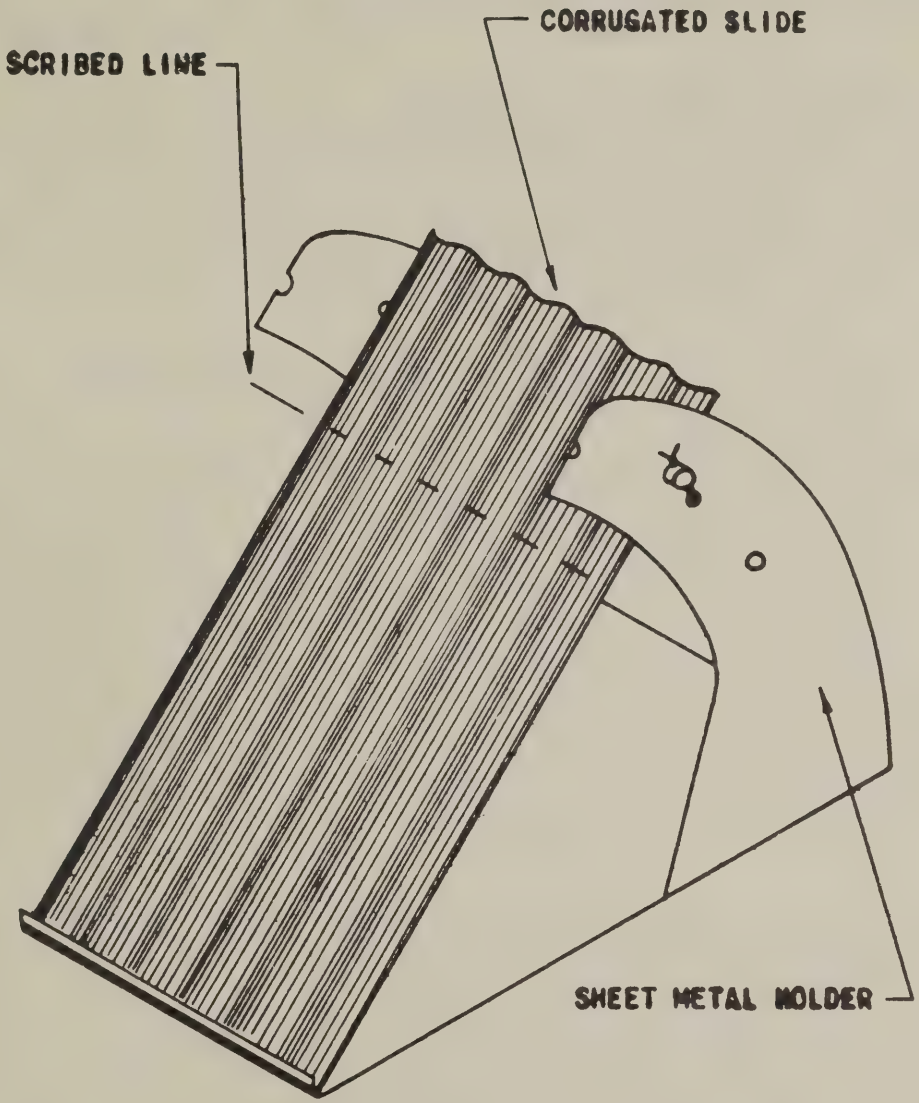

Fig. 2 FLOW TEST APPARATUS

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SECTION 12 -- PAINTING

12-01. GENERAL.- . Scope.- (1) The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, appliances, and materials, and in performing all operations in connection with preparation of surfaces, and the application of all paint or other materials in strict accordance with the specifications.

(2) Painting will be required on all uncoated ferrous surfaces except machined surfaces. Shop painting with primer and/or all paint coats will be permitted providing such painting complies with all requirements specified herein. After delivery at the site of permanent erection or installation, all shop coated metalwork shall be repainted or retouched from time to time with the specified paint, whenever in the opinion of the Contracting Officer it becomes necessary to maintain the integrity of the film.

12-02. CLEANING AND PREPARATION OF SURFACES.- (a) General.- Surfaces to be painted shall be clean before applying paint. All oil, grease, dirt, rust, loose millscale, old weathered paint, and other foreign substances shall be removed except as hereinafter specified. The removal of oil and grease shall, in general, be accomplished with solvents before mechanical cleaning is started. Clean cloths and clean fluids shall be used to avoid leaving a thin film of greasy residue on the surfaces being cleaned. Where blast cleaning is used, minor amounts of grease and oil contaminants need not be removed with solvents provided the abrasive is not reclaimed and reused. Cleaning and painting shall be so programmed that dust or other contaminants from the cleaning process will not fall on wet, newly painted surfaces. Surfaces not intended to be painted shall be suitably protected from the effects of cleaning and painting operations. Machine-finished and other bare metal surfaces, which are not to be painted but which will require temporary protection during construction, shall be treated with rust-preventive compound conforming to Military Specification MIL-C-11796A, Class 2, unless otherwise specifically indicated.

(b) Cleaning and Preparation of Ferrous Surfaces.- Ferrous surfaces shall be cleaned of all grease, dirt, rust scale, loose millscale, and other foreign substances by means of emulsions, steam, solvents, flame-cleaning, high speed-power wire brushing, scraping, and/or other approved methods. Preparation of surfaces by blasting to at least the degree of surface cleanliness indicated for the other methods of mechanical cleaning may be used at the option of the Contractor. The use of chipping tools which produce cuts, burrs, and other forms of excessive surface roughness will not be permitted. "Tight" millscale, i.e., that which cannot be lifted by applying a sharp knife to any edge, will be permitted. Minor amounts of residual rust, not removable except by thorough blast cleaning, will be permitted but rust scale shall be removed in any event. The surfaces of welds shall be given special treatment by scraping, chipping, and wire brushing to insure that slag and weld spatter are removed. Cleaned surfaces shall be primed as soon as practicable with the specified primer. Weathering of unpainted steel will not be permitted unless the surfaces are subsequently to be blast cleaned. Prior to applying subsequent coats, all welds and other damaged areas of shop-primed surfaces shall be field cleaned and reprimed as specified.

12-03. PAINT APPLICATION.- (a) General.- All work shall be done in a workmanlike manner, so that the finished surfaces will be free from runs, drops, ridges, waves, laps, and unnecessary brush marks. All coats shall be applied in such manner as to produce an even film of uniform thickness. Edges, corners, crevices, welds, and rivets shall receive special attention to insure that they receive an adequate thickness of paint. All painting shall be done by thoroughly experienced workmen. Care shall be exercised during spraying to hold the nozzle perpendicular to and sufficiently close to the surfaces being painted to avoid excessive evaporation of the volatile constituents and loss of material into the air, or the bridging over of crevices and corners. Spray equipment shall be equipped with mechanical agitators, pressure gages, and pressure regulators. Nozzles shall be of proper size. Spray painting shall be supplemented with brushing or other means where necessary to properly coat crevices, pockets, interior angles, and all other surfaces which cannot be satisfactorily coated by spray. Floors, other adjacent areas and installations shall be protected by use of drop cloths or other approved precautionary measures.

(b) Atmospheric Condition.- Paints shall be applied only to surfaces which are completely free of moisture as determined by sight or touch and only under such combination of humidity and temperatures of the ambient atmosphere and surfaces to be painted as will cause evaporation rather than condensation. In no case shall any paint be applied to surfaces upon which there is visible frost or ice. While any painting is being done, the temperature of the surfaces to be painted and of atmosphere in contact therewith, shall be at or above 50° F.

(c) Method of Paint Application.- The specified first coat of paint shall be applied by brush to ferrous surfaces, except where such surfaces have been blast cleaned, the first coat may be applied by spray or brush. All subsequent coats may be either brush or spray applied. Whenever spraying is used, it is to be understood that all areas inaccessible to spray painting shall be coated by brushing or other suitable means.

(d) Coating Progress.- Sufficient time shall elapse between successive coats to permit them to dry properly for recoating, and this minimum drying period shall be modified as necessary to suit adverse weather conditions. Paint shall be considered dry for recoating when it feels firm and does not deform or feel sticky under moderate pressure of the finger. The application of another coat of paint shall not cause such film irregularities as lifting or loss of adhesion of the undercoat and the undercoat shall have dried sufficiently so as not to retard the drying of the next coat. At all times prior to final acceptance of the work, all coats of all painted surfaces shall be unscarred and completely integral at the time of application of all succeeding coats, and when, in the opinion of the Contracting Officer it becomes necessary the integrity and continuity of all coats shall be re-established by retouching or repainting, using paints identical with those being maintained. At the time of application of each successive coat, undercoats shall be cleaned of dust, grease, or any foreign matter, which might adversely affect intercoat adhesion, by means of air blast, solvent wiping or other approved means.

12-04. PAINTS TO BE APPLIED.- (a) General.- Painting shall consist of two coats of red lead primer and two coats of aluminum paint as hereinafter prescribed. The first coat of the red lead primer and the first coat of aluminum paint shall be tinted with a small amount of ultramarine blue or lamp black or other tinting ingredients in order to insure that all surfaces are thoroughly coated with the two coats of red lead and two coats of aluminum paints.

(b) Primer.- The primer shall conform to Federal Specification TT-P-86a, for "Paint; Red-Lead-Base, Ready-Mixed," Type I.

(c) Aluminum Paste.- Aluminum paste shall conform to Federal Specification TT-A-468a for "Aluminum-Pigment; Powder And Paste, For Paint," Type II, Class B.

(d) Vehicle.- The vehicle for the aluminum paint shall conform to Federal Specification TT-V-119 for "Varnish, Spar, Phenolic-Resin." Each container of vehicle shall have instructions showing correct proportions of vehicle and aluminum pigment, and mixing instructions.

(e) Turpentine.- Turpentine for thinner shall conform to Federal Specification TT-T-801 for "Turpentine; Gum Spirits and Wood (Steam-Distilled And Sulfate) (For Use In Organic Coatings)".

(f) Mixing Aluminum Paint.- The aluminum pigment shall be mixed with the vehicle immediately prior to use. Mixing shall comply with instructions on the vehicle container as prescribed in paragraph (d) above.

12-05. PAYMENT.- No separate payment will be made for the work covered by this section and all costs in connection therewith shall be included in the contract price for the item to which the work applies.

SECTION 13 -- EMBANKMENT FOR EARTH DAM

13-01. SCOPE.- The work covered by this section consists of furnishing all plant, labor, and equipment and performing all operations in connection with preparing the embankment foundations and placing and compacting all embankment for the earth portions of the dam in accordance with the contract drawings and these specifications.

13-02. DEFINITION.- The term "earth dam" as used in these specifications is defined as the earth fill portions of the dam structure.

13-03. GENERAL PROVISIONS.- (a) Lines and Grades.- The embankment shall be constructed to the lines, grades and cross sections indicated on the drawings, unless otherwise directed by the Contracting Officer. The Government reserves the right to increase or decrease the foundation widths or the embankment slopes or to make such other changes in the embankment sections as may be deemed necessary to produce a safe structure.

(b) Conduct of the Work.- The Contractor shall maintain and protect the embankment in a satisfactory condition at all times until final completion and acceptance of all work under the contract. Any approved embankment material which is rendered unsuitable after being placed in the embankment and before final acceptance of the work, shall be replaced by the Contractor in a satisfactory manner and no additional payment will be made therefor, when such loss or damage is due to causes that are considered avoidable and are under the control of the Contractor. The Contractor shall excavate and remove from the embankment any material which the Contracting Officer considers objectionable and shall also dispose of such material and refill the excavated area as directed, all at no cost to the Government, unless the objectionable material is in the embankment through no fault of the Contractor, in which case payment will be made for the excavation and disposal of such material at the contract unit price for "Excavation, Earth, Main Dam," and the refilling of the excavation will be paid for at the applicable contract unit price for "Embankment, Compacted, 8" Layers." The Contractor may be required to remove, at his own expense, any embankment material placed outside of prescribed slope lines.

(c) Haul Roads.- The temporary and permanent access roads to be constructed under this contract may be utilized for hauling purposes. Additional haul roads shall be located and constructed as approved by the Contracting Officer. They shall be designed to be free draining and shall be maintained in good condition throughout the contract period, unless otherwise directed by the Contracting Officer.

13-04. MATERIALS.- Materials for the embankment shall be secured from the excavation for the access roads and auxiliary spillway and other required excavations. The intention is to use the most suitable materials obtainable from these sources. Material to be wasted will be specifically designated by the Contracting Officer at the time the material is excavated. Materials containing brush, roots, sod or other perishable materials will not be considered suitable. The suitability of the materials shall be subject to the approval of the Contracting Officer and their disposition in the embankment will be as directed by the Contracting Officer. Material for the earth dam embankment shall consist of clays, silty clays or clayey silts obtained from the designated excavations or borrow areas. Silts and clays containing sand may be used, if such materials are sufficiently impermeable and suitable for compacting with a tamping or rubber-tired roller.

13-05. PREPARATION OF FOUNDATION.- After excavation of unsuitable foundation material to the extent indicated on the drawings or otherwise required, the sides of stump holes, test pits, and other similar cavities or depressions shall be broken down, where so directed, so as to flatten out the slopes, and the sides of the cut or hole shall be scarified to provide bond between the foundation material and the fill. Unless otherwise directed, each depression shall be filled with suitable earth. The fill shall be placed in layers, moistened, and compacted in accordance with the applicable provisions of paragraph 13-06. Materials placed within two (2) feet of concrete surfaces shall be compacted in accordance with paragraph 13-06(c). Other materials which cannot be compacted by roller equipment because of inadequate clearances shall be spread in 8-inch layers and compacted with approved mechanical tampers to a density equal to that of the contiguous undisturbed foundation material. After filling of depressions and immediately prior to placement of compacted fill in any section of the embankment, the foundation of such section shall be loosened thoroughly by scarifying, plowing, or harrowing to a depth of 6 inches. All plowing, scarifying or harrowing shall be done parallel to the axis of the dam. After removal of roots or other debris turned up in the process of loosening, the entire surface of the embankment foundation area shall be compacted by 8 complete passes of the compaction equipment as hereinafter specified for compacted fill. No separate payment will be made for loosening and rolling the foundation area, but the entire cost thereof shall be included in the contract price per cubic yard for "Embankment, Compacted, 8" Layers."

13-06. PLACEMENT.- (a) General.- No fill shall be placed on any part of the embankment foundation until such areas have been inspected and approved. The gradation and distribution of materials throughout the compacted earth fill section of the dam shall be such that the embankment will be free from lenses, pockets, streaks, and layers of material differing substantially in texture or gradation from surrounding material of the same class. Successive loads of material shall be dumped at locations on the fill as directed or approved by the Contracting Officer. No fill shall be placed upon a frozen surface, nor shall snow, ice, or frozen earth be incorporated in the embankment.

(b) Compacted Fill.- All earth dam embankments, other than the tamped fill specified in subparagraph (c) next below, shall be placed by the compacted fill method hereinafter specified. The fill shall be placed or spread in layers not more than 8 inches in thickness prior to compaction. When the moisture content and the condition of the layers are satisfactory, each layer shall be compacted by not less than 8 passes of a tamping roller conforming to the requirements of paragraph 13-07(a). A pass shall consist of one complete coverage of the surface of a layer by the treads or feet of the compacting equipment. Portions of the embankment which the roller cannot reach for any reason shall be compacted by approved mechanical tampers to the density of the surrounding embankment. The loading of the roller shall be that designated by the Contracting Officer. In lieu of the tamping roller, the Contracting Officer may authorize the use of a heavy rubber-tired roller conforming to the requirements of paragraph 13-07(b), provided such roller will produce the desired density. Immediately before placing the material for a layer, the Contractor shall, if directed, wet the rolled surface of the preceding layer or the foundation. Materials obtained from the borrow areas or stockpiles may be either too wet or too dry to permit optimum compaction. The Contractor shall process materials in the borrow areas or stockpiles as required to bring them to approximately the correct water content for optimum compaction before placing them on the fill. Material to be placed that, after processing in the pit or stockpile, is still too wet, shall be spread on the embankment and permitted to dry, assisted by scarifying or other suitable means if necessary, until the moisture content is reduced to a value satisfactory to the Contracting Officer, after which it shall be compacted. When the material to be placed, after processing in the pit or stockpile, is still too dry, sufficient water shall be added to increase the moisture content to the amount required to give the greatest possible compaction after rolling. Manipulation of the materials will be required to work the moisture into the material until a uniform distribution of moisture has been produced. The amount of water applied on the fill shall be accurately controlled and shall be sufficient to dampen the material as required. The Contracting Officer will specify the range of moisture to which the fill materials will be processed. Sprinkling shall be done with hose suitably connected to header pipes laid along the faces of the embankment, or by other approved methods. An adequate supply of water shall be available at all times during the progress of the work. Care shall be taken to keep the area to be watered free of ruts. When, in the opinion of the Contracting Officer's field representative, the surface of any compacted layer is too smooth to permit proper bond with the succeeding layer, it shall be scarified to his satisfaction with a disc harrow or other approved equipment before the next layer is placed. Layers shall be started full out to the slope stakes and shall be carried substantially horizontal, with sufficient crown or slope to provide satisfactory drainage during construction.

(c) Tamped Fill.- All embankment placed within two (2) feet of concrete surfaces shall be placed by the tamped fill method hereinafter specified. The fill shall be placed in uniform horizontal layers not to exceed 6 inches in thickness before compaction, and each layer shall be thoroughly compacted with approved mechanical tampers before the next succeeding layer is placed. The moisture content of the fill shall be controlled in accordance with the applicable provisions of subparagraph (b) next above.

(d) Dressing.- The entire embankment shall be brought to not less than the prescribed cross section at all points. Unreasonable roughness of surface shall be dressed out.

(e) Mulching, Fertilizing and Seeding.- After dressing, those portions of the new embankment designated to be seeded, shall be mulched, fertilized and seeded in accordance with the provisions of Section 17.

13-07. COMPACTION, EQUIPMENT.- Compaction equipment shall conform to the following requirements and shall be used as prescribed in paragraph 13-06.

(a) Tamping Rollers.- Tamping rollers shall consist of one or more units. Each unit shall consist of a cylindrical drum with a drum diameter not less than 40 inches and an individual drum length of not less than 48 inches. The drums shall be water or sand and water ballasted. Each drum shall have staggered feet uniformly spaced over the cylindrical surface such as to provide approximately three tamping feet for each two square feet of drum surface. The tamper feet shall be 7 to 9 inches in clear projection from the cylindrical surface of the roller and shall have a face area of not less than 7 nor more than 16 square inches. The roller shall be equipped with cleaning fingers, so designed and attached as to prevent the accumulation of material between the tamping feet, and these cleaning fingers shall be maintained at their full length throughout the periods of use of the roller. The roller shall be capable of exerting a foot pressure of at least 250 psi when fully loaded. The design and operation of the tamping roller shall be subject to the approval of the Contracting Officer who shall have the right at any time during the prosecution of the work to direct such repairs to the tamping feet, minor alterations in the roller, and variations in the weight as may be found necessary to secure optimum compaction of the earth fill materials. The roller shall be pulled by a crawler-type tractor of sufficient power to operate the roller at a speed of approximately 3 miles per hour.

(b) Rubber-tired Rollers.- Rubber-tired rollers shall have a minimum of four wheels equipped with pneumatic tires. The tires shall be of such size and ply as can be maintained at tire pressures between 80 and 100 pounds per square inch for a 25,000 pound wheel load during rolling operations. The roller wheels shall be located abreast and be so designed that each wheel will carry approximately equal load in traversing uneven ground. The spacing of the wheels will be such that the distance between the nearest edges of adjacent tires will not be greater than 50 percent of the tire width of a single tire at the operating pressure for a 25,000 pound wheel load. The roller shall have a rigid steel frame provided with a body suitable for ballast loading such that the load per wheel may be varied, as directed by the Contracting Officer, from 18,000 to 25,000 pounds. The roller shall be towed at speeds not to exceed ten miles per hour. The character and efficiency of this equipment shall be subject to the approval of the Contracting Officer.

(c) Miscellaneous Equipment.- Hauling equipment, tractors, scarifiers, disks, spring tooth or spike tooth harrows, spreaders, and other equipment shall be of approved types, suitable for construction of the embankment.

13-08. SLIDES.- In the event of slides in any part of the embankment prior to final acceptance of the work, the Contractor shall remove material from the slide area, as directed, and shall rebuild such portion of the embankment. In case it is determined that the slide was caused through the fault of the Contractor, the removal and disposal of material and the rebuilding of the embankment shall be performed without cost to the Government; otherwise this work will be paid for at the applicable contract unit prices for "Excavation, Earth, Main Dam" and "Embankment, Compacted, 8" Layers."

13-09. SETTLEMENT GAGES.- Should the Contractor desire compensation for the placing of additional yardage due to settlement of the embankment foundation during construction, he shall erect and maintain at his own expense, in advance of making the fill, suitable devices for determination of the settlement. The type, arrangement, and spacing of these devices shall be subject to the approval of the Contracting Officer. All measurements to be used as a basis for payment shall be made by the Contractor in the presence of and verified by the Contracting Officer before acceptance of the completed embankment.

13-10. MEASUREMENT.- (a) Compacted Fill.- Embankment placed by the compacted fill method will be measured for payment as the volume between the original ground surface as determined on the basis of a survey of the areas to be filled taken by the Contracting Officer prior to the filling operations, and the theoretical cross sections established by the lines, grades, and slopes shown on the drawings or such modifications hereof as directed by the Contracting Officer, plus any allowance made for settlement of the embankment foundation during construction, if the Contractor elects to install settlement gages in accordance with paragraph 13-09, but exclusive of volumes occupied by concrete and tamped fill.

(b) Tamped Fill.- Embankment placed by the tamped fill method will be measured for payment as the volume between the exposed concrete surfaces as determined by a survey of the areas to be filled taken by the Contracting Officer prior to the filling operations and lines parallel to and two (2) feet outside of the said vertical concrete surfaces.

13-11. PAYMENT.- The cost of furnishing all plant, labor and incidentals necessary for the placement of the fill specified herein, including, preparation of foundation, excavation and hauling of materials from stockpiles or borrow area, compaction, and the control of moisture will be included in the applicable contract price per cubic yard for "Embankment, Compacted, 8" Layers" and "Fill and Backfill, Tamped, 6" Layers."

(a) Payment for all embankment placed by the compacted fill method, and measured as specified in paragraph 13-10, will be made at the contract price per cubic yard for "Embankment, Compacted, 8" Layers."

(b) Payment for all embankment placed by the tamped fill method and measured as specified in paragraph 13-10, will be made at the contract price per cubic yard for "Fill and Backfill, Tamped, 6" Layers."

SECTION 14 -- GRADING FOR AUXILIARY SPILLWAY, ACCESS ROADS AND EARTH DIKE

14-01. SCOPE.- The work covered by this section consists of furnishing all labor, supplies, equipment and materials, and performing all operations in connection with the grading required for the auxiliary spillway and the permanent and temporary access roads, including construction of the earth dike adjacent to the auxiliary spillway, all as shown on the drawings and specified herein, or as otherwise directed by the Contracting Officer.

14-02. EXCAVATION.- (a) General.- Excavation of every description and of whatever substances encountered within the limits indicated on sheets 20 and 21 of the drawings shall be performed to the lines and grades indicated on the drawings or as directed by the Contracting Officer.

(b) Order of Work.- No material shall be excavated within ten feet of the edges of the existing access road prior to completion, including surfacing, of the temporary access road.

(c) Disposition of Materials.- Excavated materials which, in the opinion of the Contracting Officer, are suitable for incorporation in the embankment or other fills shall be placed directly therein or stockpiled for future use. Approved material, in quantities sufficient to construct the earth dike adjacent to the auxiliary spillway structure and the earth dam embankment specified in Section 13, shall be stockpiled at approved locations. The existing road surfacing materials shall be wasted in the disposal area indicated therefor on the drawings. All other excavated materials, which in the opinion of the Contracting Officer are unsuitable for use as embankment material, and all surplus material shall be wasted in the area shown on the drawings for wasting surplus excavation. Material wasted in spoil or disposal areas shall be placed in a satisfactory manner that will not interfere with drainage. The material shall be so placed that it will present a neat appearance and will conform to the lines and grades shown on the drawings or as otherwise directed or authorized.

(d) Ditches.- Ditches shall be cut accurately to the cross sections and grades shown on the drawings. Care shall be taken not to excavate ditches below the grades indicated. Any excessive ditch excavation shall be backfilled to grade with suitable earth compacted to the density of the adjoining undisturbed material. Material excavated from ditches shall be used in the embankment unless otherwise directed by the Contracting Officer. Material excavated from ditches that is objectionable for embankment and any excess material shall be wasted as provided in subparagraph (c) above.

14-03. PREPARING GROUND SURFACE FOR EMBANKMENT.- The entire earth surface on or against which fill is to be placed shall be thoroughly broken to a depth of six (6) inches so that the embankment material will bond with the existing surfaces. The foundation receiving fill and all partially completed fills shall be kept thoroughly drained. No fill shall be placed upon frozen ground.

14-04. EMBANKMENT.- (a) General.- Embankments shall be constructed at the locations and to the lines and grades on sheets 20 and 21 of the drawings or as directed by the Contracting Officer. Embankment for the temporary access road, the dike adjacent to the auxiliary spillway structure, and all other fills required in connection with the grading required for the access roads and auxiliary spillway shall be constructed as hereinafter specified.

(b) Materials.- The embankments shall be constructed of earth obtained from the excavation specified in paragraph 14-02. Materials used in the embankments for the temporary access road and the earth dike, and in other fills except in the disposal areas, shall be free from roots, sod or other organic material, rocks or frozen material.

(c) Construction.- The embankment for the temporary access road, the earth dike adjacent to the auxiliary spillway structure and all other fills specified in this section, except fills placed in spoil or disposal areas, shall be placed by the semicompacted fill method hereinafter outlined. Materials shall be placed or spread in layers not more than twelve (12) inches in thickness prior to compaction. Layers shall be started full out to the slope stakes and shall be carried substantially horizontal with sufficient crown or slope to provide satisfactory drainage during construction. When in the opinion of the Contracting Officer, the surface of any compacted layer is too smooth to bond properly with the succeeding layer, it shall be scarified to the satisfaction of the Contracting Officer before the succeeding layer is placed thereon.

(1) Moisture Control.- In general, it is the intent of these specifications to secure an embankment having the maximum density obtainable consistent with the compactive effort specified. However, if in the opinion of the Contracting Officer, the material becomes either too wet or too dry for proper placement or compaction, the following procedure shall be followed:

a. Wet Material.- If, in the opinion of the Contracting Officer, the material for any reason becomes too wet to permit placement as semicompacted fill, the Contractor may either remove the wet material from the areas to be excavated and spread it in an adjacent area where it shall be permitted to dry, assisted if necessary by scarifying, until the moisture content is satisfactory, or temporarily postpone embankment construction until the Contracting Officer determines that the material is suitable for placement. In event such temporary postponement of the embankment construction delays the performance of the contract, the Contracting Officer will determine the extent of the delay to the work as a whole, and the time fixed for completion of the contract will be extented for the period of such delay.

b. Dry Material.- If, in the opinion of the Contracting Officer, the material is too dry for proper compaction, sufficient moisture shall be uniformly applied to each layer before rolling to obtain the desired compaction.

(2) Rolling Operations.- When the moisture content and conditions of the spread layers are satisfactory, each layer of material shall be compacted by not less than four (4) complete passes of the loaded hauling equipment, a crawler type tractor weighing at least 10 tons and exerting a unit pressure of not less than six (6) pounds per square inch, or a tamping type roller conforming to the requirements of subparagraph 13-07(a), or by not less than (2) complete passes of a rubber-tired roller conforming to the requirements of subparagraph 13-07(b). A pass shall consist of one complete coverage of the entire surface of a layer by the treads or feet of the compacting equipment.

If tamping rollers are used in tandem not more than two rows will be permitted and in such case, one trip of the tandem rollers over any surface will be considered as two (2) passes. When tamping rollers are used in tandem the tamper foot spacing shall be offset so that the circumferential rows on the rear drums are in line with the mid-point of the circumferential rows on the forward drums. Each pass of the tamping roller shall overlap the preceding or adjacent pass by not less than one (1) foot. Portions of the embankment which the roller cannot reach for any reason shall be compacted by any approved method to the density of the surrounding embankment.

14-05. FINISHED EXCAVATION FILLS AND EMBANKMENTS.- (a) Graded Areas.- Uniformly smooth grading of all areas herein specified, including excavated and filled sections and adjacent transition areas, shall be accomplished. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from either blade-grader or scraper operations and shall be subject to the approval of the Contracting Officer. All ditches shall be finished so as to drain readily. The permanent access road shall be crowned six (6) inches at the roadway centerline and the temporary access road shall be crowned approximately three (3) inches at its centerline.

(b) Earth Dike.- The entire earth dike embankment shall be brought to not less than the prescribed cross section at all points. Unreasonable roughness of surface shall be dressed out.

14-06. MAINTENANCE.- The earth dike and all newly graded areas shall be protected from the action of the elements, and any settlement or washing that may occur from that or any other cause, prior to acceptance of the work, shall be repaired, and grades re-established to the required elevations and slopes, all at no additional expense to the Government.

14-07. MEASUREMENT.- (a) Excavation.- All excavation required for the grading specified in this section will be measured for payment by the cubic yard and quantities will be determined by the average end area method. The basis for the measurement will be cross sections of the area to be graded, taken by the Contracting Officer prior to commencement of the grading operations, and the theoretical cross sections established by the lines, grades, slopes, and other dimensions shown on the drawings or such modifications thereof as ordered by the Contracting Officer.

(b) Embankment.- (1) Grading.- Except as otherwise specified in subparagraph (2) next below, materials placed in embankments or fills required for the grading specified in this section will not be measured for payment.

(2) Earth Dike.- Embankment materials placed in the earth dike adjacent to the auxiliary spillway structure will be measured for payment by the cubic yard and quantities shall be determined by the average end area method. The basis for the measurement will be cross sections of the area, taken after completion of the auxiliary spillway structure and the placement of riprap adjacent thereto but prior to construction of the dike, and the theroretical cross sections established by the grades, side slopes, crown widths and other dimensions shown on the drawings or such modifications thereof as ordered by the Contracting Officer.

14-08. PAYMENT.- (a) Excavation.- Payment for all excavation performed as required for the grading specified in this section and measured as specified in paragraph 14-07(a), will be made at the contract price per cubic yard for "Excavation, Access Roads and Auxiliary Spillway," which price and payment shall constitute full compensation for all costs of labor, equipment, tools, supplies and incidentals required to complete the grading operations, including excavation, stockpiling, hauling, construction and compaction of and moisture control for the required embankments and fills,(except the earth dike adjacent to the auxiliary spillway),finishing and maintenance of completed slopes and surfaces, and disposal of all surplus and unsuitable materials.

(b) Embankment.- (1) Grading.- Except as otherwise specified in subparagraph (2) next below, no separate payment will be made for construction of the embankments or fills required in connection with the grading operations and all costs thereof shall be included in the contract price per cubic yard for "Excavation, Access Roads and Auxiliary Spillway."

(2) Earth Dike.- Payment for all embankment, placed as required in the earth dike adjacent to the auxiliary spillway structure and measured as specified in paragraph 14-07(b)(2), will be made at the contract price per cubic yard for "Embankment, Semicompacted, 12" Layers", which price and payment shall constitute full compensation for all costs of labor, equipment, tools, supplies and incidentals required to construct the earth dike, including preparation of foundation, excavating and hauling material from stockpiles, moisture control, placing and compacting the embankment, and finishing and maintenance of the completed slopes and surfaces of the dike.

SECTION 15 -- STONE PROTECTION

15-01. SCOPE.- The work covered by this section consists of furnishing all plant, labor, equipment, and materials, except materials specified to be furnished by the Government, and performing all operations in connection with the construction of stone work for the protection of earth surfaces as shown on the drawings or as directed by the Contracting Officer in accordance with these specifications and applicable drawings.

15-02. LIMITS OF WORK.- (a) Riprap.- Riprap stone shall be placed along the upstream (southern) edge of the auxiliary spillway between approximate stations 3+06 and 6+86. The riprap shall be 10 feet in width, and shall be placed prior to construction of the earth dike in such manner that the top of the riprap will be level with the top of the auxiliary spillway.

(b) Riprap and Filter Stone.- Stone protection consisting of riprap stone placed over a 6 inch layer of filter stone shall be constructed at the following locations:

(1) On the upstream side slopes of the earth portions of the dam between the toe of the slope and elevation 520.0 msl.

(2) On the upstream (southern) side slope of the earth dike between the toe of the dike and elevation 512.0 msl.

(3) On the channel side slopes at each end of the derrick stone protection along the downstream end of the stilling basin all as shown on the drawings.

(c) Derrick Stone.- Derrick stone shall be placed along the downstream end of the stilling basin, to the depths and widths indicated on the drawings.

(d) Derrick Stone and Filter Blanket.- A two-course filter blanket of crushed stone shall be placed by the Contractor along the downstream (north) edge of the auxiliary spillway between approximate stations 3+06 and 6+86 to the elevations and extent indicated on the drawings. Derrick stone shall be placed over the filter blanket so that the top of the derrick stone will be level with the top of the auxiliary spillway.

15-03. MATERIALS.- (a) General.- All stone for the protection work shall be durable stone as approved by the Contracting Officer. The sources from which the Contractor proposes to obtain the material shall be selected well in advance of the time when the material will be required in the work. No stone shall be delivered to the site of the work until the source has been approved by the Contracting Officer. Suitable samples of filter and filter blanket stone shall be submitted to the Contracting Officer for approval prior to delivery of any such material to the site of the work. Unless otherwise specified, all such samples shall be obtained by the Contractor and delivered at his expense to a point designated by the Contracting Officer at least 30 days in advance of the time when the placing of the stone protection is expected to begin.

(b) Quality.- Suitable tests and service records will be used to determine the acceptability of the stone protection materials. In the event suitable test reports and a service record, that are satisfactory to the Contracting Officer, are not available, as in the case of newly operated sources, the material shall be subjected to such tests as are necessary to determine its acceptability for use in the work. Tests to which the materials may be subjected include petrographic analysis, specific gravity, abrasion, absorption, wetting and drying, freezing and thawing, and such other tests as may be considered necessary to demonstrate to the satisfaction of the Contracting Officer that the materials are acceptable for use in the work. All tests will be made by or under the supervision of the Government and at its expense.

(c) Filter Stone.- Filter material beneath the riprap shall consist of crushed stone. The material shall be composed of tough, durable particles, shall be reasonably free from thin, flat and elongated pieces, and shall contain no organic matter nor soft, friable particles in quantities considered objectionable by the Contracting Officer. Materials shall be well graded between the following limits:

Sieve Designation (U. S. Std. Sq. Mesh)	Percent by Wt. Passing
2 inch	90-100
1 inch	40-70
No. 4	0-10

(d) Filter Blanket.- The two-course filter blanket beneath the derrick stone along the auxiliary spillway shall consist of crushed stone. The materials shall be composed of tough durable particles, shall be reasonably free from thin, flat and elongated pieces, and shall contain no organic matter or soft, friable particles in quantities considered objectionable by the Contracing Officer. Materials for the lower course shall be filter stone conforming to the requirements of subparagraph (c) next above. Materials for the upper course shall be well graded within the following limits:

Sieve Designation (U. S. Std. Sq. Mesh)	Percent by Weight Passing
3 inch	90-100
2 inch	20-55
1-1/2 inch	0-10

(e) Riprap and Derrick Stone.- Stone for riprap and derrick stone shall be of hard, durable quality that will not disintegrate under the elements nor be easily broken in handling. It shall be free from cracks, seams, and other defects that would tend to increase unduly its deterioration from natural causes. The inclusion of objectionable quantities of dirt, sand, clay, and rock fines will not be permitted. The stone shall be well graded from fine to large and shall conform to the following additional requirements.

(1) Riprap Stone.- Riprap stone shall be in pieces weighing not more than 200 pounds and shall conform to the following limitations:

At least 15 percent by weight in pieces 80 to 200 lbs.
At least 50 percent by weight in pieces 20 to 80 lbs.
At least 10 percent by weight in pieces 3 to 20 lbs.

Not more than 5 percent by weight in pieces under 3 lbs.

(2) Derrick Stone. Derrick stone shall be in pieces weighing not more than 4000 pounds and at least 90 percent by weight shall be in pieces weighing between 150 and 4000 pounds.

15-04. FOUNDATION PREPARATION.- Areas on which stone protection is to be placed, shall be trimmed and dressed to conform to cross sections shown on the drawings; however; no rock excavation will be required for this purpose. Immediately prior to placing any stone protection materials, the prepared base will be inspected by the Contracting Officer and no material shall be placed thereon until that area has been approved.

15-05. PLACING.- (a) Filter Stone.- Where required, a filter base course, consisting of a 6 inch layer of filter stone conforming to subparagraph 15-03 (c), shall be placed prior to placing the riprap stone. The filter course material shall be spread uniformly on the prepared base, in a satisfactory manner to the lines shown on the drawings or as otherwise required. No material shall be placed on frozen ground. Any damage to the filter course during its placement or during the placement of the riprap stone thereover shall be repaired before proceeding with the work.

(b) Riprap Stone.- Riprap stone, conforming to paragraph 15-03(e)(1), shall be placed over the filter course or prepared base as required by dumping from truck, skip, chamshell or other method approved by the Contracting Officer and shall be rearranged as necessary to provide a reasonably well graded mass of rock having an average thickness above the filter course as indicated on the drawings, with local tolerances of plus 6 inches or minus 2 inches being permitted. All sharp projecting edges, mounds and windrows shall be struck off and all depressions and holes properly filled.

(c) Filter Blanket.- Prior to placing the derrick stone along the auxiliary spillway, there shall be placed a two-course filter blanket of crushed stone conforming to paragraph 15-03(d). Each course shall be six inches in thickness. Material for the lower course shall be spread uniformly on the prepared base, in a satisfactory manner, to the lines shown on the drawings or otherwise required. No material shall be placed on frozen ground. Material for the upper course shall then be spread uniformly over the lower course. Any damage to the filter blanket during its placement or during the placement of derrick stone thereover shall be repaired before proceeding with the work.

(d) Derrick Stone.- Derrick stone adjacent to the auxiliary spillway shall be placed over the two course filter blanket prescribed in paragraph 15-05(c). Derrick stone adjacent to the stilling basin shall be placed on a prepared rock and/or earth foundation. Derrick stone shall be placed in such a manner as to produce a reasonably well-graded mass with the minimum practicable percentage of voids. The larger stones shall be well distributed throughout the mass and the finished work shall be free from pockets of small stones and clusters of large stones. The finished surface shall present a reasonably smooth surface as determined by the Contracting Officer, and shall conform to the grades shown on the drawings or such modifications thereof as ordered by the Contracting Officer, except that local tolerances, of 12 inches over, or 6 inches under the prescribed grades will be permitted in the finished surface.

15-06. MEASUREMENT AND PAYMENT.- (a) Measurement.- The filter and filter blanket stone, derrick stone and riprap stone specified in this section will each be measured for payment by the ton (2000 pounds). The weights to be paid for will be determined from certified weight tickets which shall be furnished to the Contracting Officer by the Contractor.

(b) Payment.- (1) Payment for both the filter and filter blanket stone will be made at the contract price per ton for "Stone, Filter Course," which price and payment shall constitute full compensation for foundation preparation, furnishing, hauling, handling and placing the filter stone and stone for both the upper and lower courses of the filter blanket, and performing all incidental operations required to satisfactorily construct the filter courses at the locations specified hereinabove.

(2) Payment for the riprap stone will be made at the contract price per ton for "Stone, Riprap", which price and payment shall constitute full compensation for furnishing, hauling, handling and placing the riprap stone and performing all incidental operations required to satisfactorily construct the revetment at the locations specified hereinabove.

(3) Derrick Stone.- Payment for the derrick stone will be made at the contract price per ton for "Derrick Stone," which price and payment shall constitute full compensation for foundation preparation, for furnishing, hauling, handling and placing the derrick stone and performing all incidental operations required in connection therewith.

(4) Excavation.- Excavation required for placement of all derrick stone, and the riprap stone under the earth dike adjacent to the auxiliary spillway will be measured and paid for at the applicable contract price per cubic yard for "Excavation, Earth, Main Dam" or "Excavation, Structure, Auxiliary Spillway" as specified in Section 2.

SECTION 16 — CRUSHED STONE ROAD SURFACING

16-01. SCOPE.- The work covered under this section consists of furnishing all plant, labor, supplies, equipment and materials and performing all operations in connection with the preparation of subgrade and the construction of a crushed stone surface course on the permanent and temporary access roads to be constructed under this contract and on the temporary parking area adjacent to the Government field office as specified in paragraph 2-13, the repair of the existing access roads and the maintenance of such roads and parking area, all as shown on the drawings or hereinafter specified.

16-02. MATERIAL.- (a) General.- The surfacing material shall be crushed stone of hard, strong, durable particles, reasonably free from an excess of soft or unsound pieces and other objectionable matter.

(b) Gradation.- (1) The crushed stone shall be well graded within the prescribed limits and shall meet the requirements for grading given in the following tables, using A.A.S.H.O. Method T-27-46 for "Standard Method of Test For Sieve Analysis Of Fine And Coarse Aggregate."

Size	Percent by Weight Passing Square Mesh Sieves
1 inch	100
1/2 inch	60-90
No. 4	40-60
No. 8	25-50
No. 16	20-40
No. 200	5-15

(2) The Contractor may provide crushed stone having somewhat different gradations than those stated above, provided such material meets the approval of the Contracting Officer and will give a type of road comparable to the gradation specified.

(c) Sampling and Testing.- All samples of crushed stone shall be supplied by the Contractor at his expense and all tests necessary to determine the requirements specified herein will be performed by and under the supervision of the Contracting Officer without cost to the Contractor. The source of the material to be used for surfacing shall be selected by the Contractor well in advance of the time when it will be required in the work, and samples of the size required shall be furnished to the Contracting Officer. All materials shall be approved by the Contracting Officer prior to use in the work. Additional samples shall be furnished by the Contractor during the construction as directed by the Contracting Officer. Unless otherwise directed, A.A.S.H.O. Method T-2-46 "Standard Method of Sampling Stone, Slag, Gravel, Sand and Stone Block for Use as Highway Materials," shall be used for sampling of materials.

16-03. LIMITS OF ROAD SURFACING.- The Contracting Officer reserves the right to require the Contractor to omit surfacing on certain reaches and/or to surface such additional reaches as he may direct. The thickness of surfacing materials shown on the drawings indicates the thickness before compaction.

16-04. PREPARATION OF SUBGRADE.- (a) The permanent and temporary access roads to be constructed under this contract shall be crowned at the center as provided in paragraph 14-05. The parking area adjacent to the Government field office shall be constructed to lines and grades determined in the field by the Contracting Officer. Any blading or grading necessary to maintain or re-establish the prescribed cross section due to damage by erosion, Contractor's operations or any other cause, shall be performed by the Contractor without additional compensation.

(b) Prior to surfacing the existing access roads to be repaired, a suitable subgrade shall be established by blading and shaping the existing roadway and filling all potholes and depressions with crushed stone conforming to the requirements of paragraph 16-02. The finished subgrade shall present a uniform surface with as high a crown at the centerline as practicable up to but not exceeding six (6) inches.

(c) After the required subgrade has been established and approved by the Contracting Officer, the area to receive stone road surfacing shall be compacted by an approved pneumatic-tired roller, making not less than 4 passes over the entire area to be surfaced. The roller may conform to the provisions of paragraph 16-05(b) or a rubber-tired roller conforming to paragraph 13-07(b) may be used. This subgrade shall be maintained to the proper grade and cross section by the Contractor during construction. Any ruts, rain wash, uneven spots or depressions that exist or which develop in the road subgrade shall be corrected by loosening, reshaping, filling and recompacting to grade and cross section as directed by the Contracting Officer.

16-05. EQUIPMENT.- (a) General.- All equipment, tools, and machines, shall be subject to the approval of the Contracting Officer and must be maintained in satisfactory working condition at all times.

(b) Pneumatic-Tired Rollers shall consist of two axles on which are mounted not less than 9 pneumatic-tired wheels in such manner that the rear group of tires will not follow in the tracks of the forward group. The axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. The tires shall be uniformly inflated. The rollers shall be weighted as directed by the Contracting Officer. The tractor or other towing equipment shall also be pneumatic-tired.

16-06. CONSTRUCTION METHODS.- (a) Method of Depositing Material.- The material shall be hauled to the area to be surfaced in approved pneumatic-tired vehicles. Material shall be deposited uniformly on the prepared subgrade from moving vehicles, spreader boxes or other approved devices. Surfacing material shall be deposited in such a manner that the finished surfacing shall have a feathered edge, 1 foot in width on each side of the surfacing. These feathered edges shall be outside of and in addition to the widths of surfacing shown on the drawings. Placing of material shall start at the portion of road nearest the source of supply, unless otherwise authorized by the Contracting Officer.

(b) Spreading and Compacting Materials.- As soon as practicable after the material has been deposited, it shall be spread to the approximate cross section, and compacted by routing the hauling equipment over the spread material so that it will cover the entire width of surfacing or, in lieu of routing the hauling equipment over the surfacing, the Contractor may, at his option, make 4 passes over the surface with a pneumatic-tired roller conforming either to paragraph 16-05(b) or paragraph 13-07(b).

16-07. OIL SURFACE TREATMENT.- (a) General.- After spreading and compacting of the crushed stone surfacing on access roads and parking area as required, a suitable road oil shall be applied over the stone surfacing to control dust. At the time the oil is applied, the road and parking area surfaces shall be smooth, and dry.

(b) Material.- The road oil shall be a medium grade, slow curing, asphaltic oil, showing no separation on standing, and shall conform to the following requirements:

Water by volume, %.	0.5 -
Flash Point (Cleveland Open Cup)° F.	200.0 +
Viscosity, Saybolt Furol, at 122° F., sec.	135 to 240
Bitumen Soluble in carbon disulphide, %.	99.5 +
Residue of 100% penetration, %	55 +
Ductility at 77° F., of residue of specified penetration	100 cm +

(c) Seasonal and Temperature Limitations.- No oil shall be applied when the air temperature in the shade is less than 50° F., or when local conditions indicate that rain is imminent.

(d) Quantity of Oil.- The total quantity of oil to be applied shall be 0.25 gallon per square yard of surface.

(e) Application of Oil.- The temperature of the oil at the time of application shall be such that it will spray uniformly without clogging the spraying nozzles. In no case shall the temperature be more than 200° F. The oil shall be applied in one (1) application at a rate of 0.25 gallon per square yard. The roads and/or parking area shall be closed to traffic during the application of the oil, and shall remain closed for a period of not less than 24 hours after the application, or longer if deemed necessary by the Contracting Officer.

16-08. MAINTENANCE.- Until completion of all work under this contract, the Contractor shall shape and drag or blade the surfacing on the parking area and on the access roads leading from the county road to the dam site as shown on Drawing No. 801.1421 as often as necessary to maintain a smooth surface. If holes, depressions, or other unsatisfactory areas develop in the surfacing that cannot be corrected by blading and shaping, the Contractor shall correct such areas by adding more road surfacing materials. If soft spots develop in the subgrade the Contractor will be required to remove the unsatisfactory material from the subgrade and replace with satisfactory material which shall be compacted before the road surfacing material is placed thereon. If at any time during the life of the contract the oil surfacing becomes deficient, in the opinion of the Contracting Officer, the Contractor will be required to add oil at a rate of not over 0.25 gallon per square yard to such damaged areas.

16-09. METHOD OF MEASUREMENT.- Crushed stone used for preparing the subgrade as specified in paragraph 16-04(b) and for surfacing the access roads and parking area as required will be measured for payment by the short ton (2,000 lb). The weights to be paid for will be determined from certified weight tickets which shall be furnished by the Contractor to the Contracting Officer. Additional stone required for maintaining the roads as specified in paragraph 16-08 will not be measured for payment.

16-10. PAYMENT.- The quantities of crushed stone, measured as provided in paragraph 16-09 above, will be paid for at the contract price per ton for "Road Surfacing, Crushed Stone". This price and payment shall constitute full compensation for preparing and maintaining the subgrade as specified in paragraph 16-04, furnishing all materials, equipment and tools; hauling, placing, spreading, shaping and oiling the surfacing materials; placing feathered edges; maintaining the surfacing as specified in paragraph 16-08; and all labor and incidental operations necessary to complete this work.

SECTION 17 -- MULCHING, FERTILIZING AND SEEDING

17-01. SCOPE.- (a) The work covered by this section of the specifications consists of furnishing all materials, equipment, plant, and labor and performing all work required for mulching, fertilizing and seeding the surfaces specified in paragraph (b) next below or directed by the Contracting Officer. The Contracting Officer reserves the right to eliminate any or all of the work covered herein.

(b) The surfaces to be mulched, fertilized and seeded include all new earth surfaces of the dam, the backfill downstream of the dam, the earth dike along the auxiliary spillway, the permanent access road shoulders and side slopes, and the 1 on 3 side slopes of the auxiliary spillway. The Contractor shall also perform such additional mulching, fertilizing and seeding as may be directed in the field by the Contracting Officer.

17-02. TIME OF SEEDING.- (a) Except as otherwise provided in paragraph (c) below, seeding shall be performed within the seeding seasons listed below. The seeding work shall be prosecuted at a rate which will insure the seeding of all completed embankment within the times permitted for such work; however, seeding work shall not be performed when conditions, as determined by the Contracting Officer, are unfavorable for such work.

SEEDING SEASONS

Fall Seeding	15 August to 20 September
Spring Seeding	15 February to 15 April

(b) In the event of fall seeding, the seeding of legumes shall be postponed until the beginning of the next spring seeding season, and then the legumes shall be broadcast over the seeded area between 15 February and 15 March. In event all other work under the contract has been completed, and the Contractor is prevented from completing the seeding of legumes because of the seasonal limitations provided herein above, the seeding of legumes will be eliminated from the contract if so requested in writing by the Contractor and approved by the Contracting Officer.

(c) The Contractor may, at his own risk, perform seeding at times other than those specified in subparagraph (a) and (b) next above. If seeding is performed outside the prescribed seeding seasons and a proper stand of grass is obtained, in the opinion of the Contracting Officer, by the start of the next seeding season, the seeding work will be accepted as satisfactory. If a proper stand of grass is not obtained, the designated areas shall be remulched, refertilized and reseeded by the Contractor at no additional cost to the Government.

17-03. PREPARATION OF SEEDBED.- The Contractor shall repair and dress or redress the surfaces specified herein to be seeded. Immediately prior to placing mulch, all surfaces specified to be seeded shall be thoroughly loosened to a depth of not more than 4 inches by disking, harrowing or by other approved methods, until the tilth is acceptable to the Contracting Officer.

17-04. MULCHING OF SEEDBED.- After the seedbed has been prepared as specified in paragraph 17-03 above, the entire area shall be covered with a straw mulch. The mulch shall be applied uniformly at a rate of 4,000 pounds per acre. The mulch material shall be good quality wheat or rye straw free from Johnson Grass and/or other objectionable grasses and weeds. The mulch shall be spread by hand, straw spreader, or other suitable equipment, and then lightly disked.

17-05. PREPARING SEEDBED AND MULCHING OUTSIDE OF SEEDING SEASON.- In order to reduce erosion, the Contractor may, during non-seeding seasons, prepare the seedbed and place the straw mulch immediately after completion of the embankment. The mulch shall be lightly disked and allowed to stand until the next specified seeding season. It shall be disked again immediately prior to seeding. Any damage which has occured during the non-seeding periods shall be repaired and additional straw placed where it has become deficient because of wind, erosion or other cause.

17-06. FERTILIZER.- At the time of seeding, the Contractor shall apply an approved 33% ammonium nitrate fertilizer, or an approved equivalent thereof, in such quantity as will yield 50 pounds of nitrogen per acre. In the case of 33% ammonium nitrate, the above provision will be interpreted to require 150 pounds of fertilizer per acre. Fertilizer shall be applied by drill, or broadcast uniformly on the area. The fertilizer shall be incorporated into the soil by disking or harrowing.

17-07. SEED.- (a) Mixture.- The following seed mixture shall be applied to the surface specified to be seeded.

Seed Mixture Per Acre

Smooth Brome Grass (Southern Strain)	20 lbs (pure live seed)
*Alsike Clover	3 lbs (pure live seed)
*Ladino Clover	1 lb (pure live seed)
Perennial Rye Grass	5 lbs (pure live seed)
*Lespedeza (Korean), Unhulled	5 lbs (pure live seed)

*Indicates Legumes

(b) Pure Live Seed Content.- For each seed ingredient in the mixture the minimum percentage (by weight) of pure live seed (percentage purity X percentage germination) shall be as listed below. All legume live seed percentages include hard seed.

Smooth Brome Grass (Southern Strain)	65%
Alsike Clover	87%
Ladino Clover	88%
Perrennial Rye Grass	88%
Lespedeza (Korean), Unhulled	86%

All seed containers shall be tagged or labeled to show the percentages of purity and germination. By multiplying these two percentages for each ingredient, it will be determined if the above minimum requirements have been complied with. The percentage of weed seed shall not exceed that allowed by the laws of the state in which delivery is to be made. To determine the actual weights of each seed ingredient required in the seed mixture, the following formula shall be used.

$$\frac{\text{Lbs pure live seed (Par. 17-07 (a))}}{\text{Actual percent of pure live seed}} \times 100 = \text{Actual pounds of seed required.}$$

(c) Legume Seed Inoculation.- The legume seed shall be properly inoculated with approved inoculant not more than 4 hours prior to seeding. The inoculant shall be applied in accordance with the manufacturer's directions, as approved by the Contracting Officer.

17-08. PLANTING SEED.- Except for separate legume seeding as specified in paragraph 17-09, the seed shall be sown over the mulch by either a hand type or power drawn type of seeder in a manner satisfactory to the Contracting Officer. Immediately after sowing, the seed shall be covered by a cultipacker.

17-09. SEPARATE LEGUME SEEDING.- Where legumes are seeded separately in accordance with the provisions of paragraph 17-02(b), any portions of the seeded areas which have been damaged by rain wash or other causes shall be repaired without additional cost to the Government by redressing, remulching, refertilizing and reseeding the damaged areas to the satisfaction of the Contracting Officer, after which the legume seed shall be broadcast over the seeded areas in an approved manner.

17-10. MEASUREMENT AND PAYMENT.- For payment purposes, seeded areas will be computed to the nearest tenth acre for the areas actually seeded as required, based on measurements made in the field by the Contracting Officer. Payment for performing all operations (including the furnishing of all necessary materials) required for preparing the seedbed, mulching and fertilizing, and for sowing all seed except legumes, will be made at the contract price per acre for "Mulching, Fertilizing and Seeding (Except Legumes)." Payment for furnishing and sowing legumes will be made at the contract price per acre for "Seeding of Legumes."

SECTION 18 -- CULVERT PIPE FOR ACCESS ROAD

18-01. SCOPE.- The work covered by this section of the specifications consists of furnishing all plant, labor, materials and equipment, and performing all operations in connection with the installation of culvert pipe at the location indicated below, as shown on the drawings and as specified herein.

18-02. LOCATION.- A galvanized, corrugated metal pipe culvert, approximately 56 feet in length, shall be installed under the temporary access road at approximate station 6+52.

18-03. MATERIALS FOR PIPE CULVERTS.- Pipe for the culvert and coupling band therefor shall be galvanized, corrugated metal conforming to the applicable requirements of Federal Specification QQ-C-806a for "Culverts And Underdrains, Corrugated Iron Or Steel, Zinc-Coated," Type I, Class 2. The culvert pipe shall be 12-inch diameter No. 14 gage pipe. Coupling bands shall be standard 7-inch coupling bands conforming to the aforesaid specifications.

18-04. INSTALLATION OF PIPE FOR CULVERT.- (a) General.- A trench shall be excavated as required for the installation of the culvert pipe. The trench shall be kept to the minimum width necessary for the proper installation of the pipe, and the bottom of the trench shall be rounded so that the lower portion of the pipe bears on firm material. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or the weather are unsuitable for such work. The pipe shall be carefully inspected by the inspector immediately before it is laid and defective pipe will be rejected. Pipe shall be cleaned and lowered into position in such a manner as to avoid unnecessary handling or injury to the pipe or its coating. The pipe shall be laid on a firm foundation with the invert of the pipe set at the elevations indicated on the drawings. Each section of pipe shall rest upon the pipe bed for its full length with recesses excavated to accommodate the joints or couplings. Any pipe which has its grade or joint disturbed after laying shall be taken up and relaid. Any section of pipe already laid which is found to be defective or damaged shall be taken up and relaid or replaced as directed by the Contracting Officer, without additional cost to the Government.

(b) Installation.- The pipe shall be laid with the separate sections joined firmly together. During installation, the pipe shall be handled with care so as not to damage the galvanized coating. The coupling bands shall lap an equal portion on each section joined, and the ends of adjacent pipe sections shall be spaced so that the corrugations of the coupling band mesh with those of the pipe. The distance between ends of pipe shall be the minimum for such meshing.

(c) Backfilling Over Pipe.- As soon as practicable after the culvert pipe has been placed and approved, backfill or fill shall be brought up evenly on both sides of the pipe to an elevation 2.0 feet above the top of the pipe. Each layer shall be uniform, not exceeding 6 inches in thickness before compaction. Compaction shall be accomplished with approved mechanical backfill tampers to a density equal to that of the adjacent undisturbed material. Special care shall be taken to secure thorough compaction under the haunches of the pipe. The remaining fill or backfill for the culvert above the tamped fill shall be placed by the semi-compacted method of placement specified in Section 14 for the access roads.

18-05. PAYMENT.- Payment for the actual length of galvanized, corrugated metal culvert pipe, installed complete as required, will be made at the contract price per linear foot for "Culvert Pipe, 12-inch Diameter." This price and payment shall constitute full compensation for all costs of plant, labor and materials for furnishing and installing the culvert pipe and coupling bands, all excavation and backfill required for the installation, and for performing all incidental operations required to satisfactorily complete the installation. Measurement for payment purposes will be made for the actual length of pipe in place as required.

St. Louis District
Corps of Engineers
U. S. Army

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